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Lessons of the Spanish War

An Estimate of the Military Factors: Men and Matériel

By Liddell Hart*

BECAUSE of the natural fog of war it always has been difficult to gauge the course of a campaign actually in progress, and it has become more difficult with the modern development of censorship and propaganda in creating artificial "smoke." The outline of military events in Spain has now, however, become clear enough to enable the distant observer to estimate the situation and the factors which have governed it. During the autumn and most of the winter of 1936, a state of deadlock prevailed, hardened by the weather. During these months the Government forces as a whole remained on the defensive and succeeded, despite their inferior equipment and training, in frustrating the Nationalists' efforts to extend their gains.

With each month of continued successful resistance the Government's prospects were more likely to improve—so long, at any rate, as General Franco did not receive a great increase of assistance from foreign sources. The deadlock was broken by the fall of Malaga—a Nationalist coup marked by good strategic judgment as well as by Italian backing on a new and important scale. The resistance was slight—its moral stability being easily shaken by the effect of surprise on a state of unpreparedness.

The effort had a significant moral reaction. The Government were spurred to change their strategy, and to attempt a widespread change of offensives. These, as was to be expected, made no great material impression, except on the casualty totals. As also was to be expected, the exhaustion of the attackers offered a more promising opportunity for the Nationalist forces to renew their offensive. It remained to be seen whether General Franco's troops were capable of exploiting it sufficiently under the conditions of modern warfare. Their most threatening effort was the 3-pronged stroke from Siguenza southwestward toward Guadalajara and Madrid, delivered on March 8, 1937. While it preserved the assets of surprise and mobility its promise was high, but these waned all the sooner because of the intervention of "General Mud," which gave the resistance time to harden and to be reënforced by General Miaja.

Stuck in the mud, the Italians who largely composed the attacking force soon became ripe objects for a counterstroke, which came on March 13th. Its dramatic success repeated the experience of the World War, where the greatest victories, so long as the forces were fairly well matched, were produced by action of the counteroffensive form. It also showed, as the Abyssinian War had shown previously, that aircraft are specially formidable in such action and that their advent has greatly enhanced its power. In Abyssinia the Italians had been the demonstrators of this development; at Guadalajara they served as the body on which the demonstration was performed.

While this is a lesson, now amply attested, to which all those who are concerned with the creation of armies may well pay attention, we should curb the inclination to draw too-detailed deductions of general application from particular episodes of the Spanish war. There was, for example, a hasty inclination to regard the Guadalajara offensive as a trial of mechanized forces and an exposure of their defects. Commentators even described it as the first big battle in which modern "mechanized divisions" had been employed. Yet the narratives showed that the bulk of the attacking force was composed of infantry who were merely carried in lorries and who had to dismount before attacking. These more precisely would be described as "motorized" divisions; even so, it would appear that most of their vehicles were far from being of a modern kind adequately adapted to movement off the roads.

THE inability of the temporarily lorry-borne infantry to attack effectively after they had dismounted provided a reminder that mud can be a barrier to men on their feet as well as to men on wheels, especially when the barrier is thickened by machine guns. In weighing the difficulties also met by the accompanying tanks, account should be taken of the fact that the small German and Italian tanks here employed already were recognized as too small and otherwise unsuited for surmounting serious obstacles. This, of course, does not imply that larger and better machines would be unaffected by mud if it were sufficiently bad. Twenty years ago, Passchendaele taught a lesson in the folly of using tanks in swamplike conditions, if also of pursuing an offensive by any means in such conditions.

It is as curious a reflection that these lessons should have been ignored by the Nationalist leaders as that the natural result should have been regarded as an adverse revelation on mechanization. Those who have studied the subject of mechanized warfare long have insisted on the importance of distinguishing between fully mechanized and merely motor-

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ized troops. They have pointed out that to make the best of the former and diminish the dangers of air attack, the scale of man power, and consequently of superfluous vehicles, should be much reduced; that the force should be composed of armored vehicles of high cross-country performance; that it should be trained to keep off the roads, to move on wide fronts, and to maintain a state of controlled dispersion. Only when these conditions are fulfilled is there any reliable guide to the value of mechanized forces.

Even so, such inferences as can be drawn from symptoms in Spain tend to support the view that the ultimate general effect of mechanization will be toward enhancing the power of defense through increasing rapidity of reënforcement and countermove, rather than toward reviving the power of the offensive.

The chief threat to the solidity and endurance of modern defense comes from the effect, predominantly moral, of intensive air attack. This was illustrated in the offensive which the Nationalists, balked elsewhere, undertook in the spring against the Basque territory in the north. Frequent clouds in the mountains at first hindered the use of the mass of Italian and German aircraft which had been concentrated for the purpose, and so long as this friendly cloak remained to compensate the Basques' lack of air defenses they proved able, though only a militia, to hold up the attack of superior ground forces. The experience showed that so long as troops in defense have the spirit to resist, their resistance is likely to prevail even under adverse conditions of training and equipment. A change in the situation came with a temporary improvement of flying conditions, and the progress which the Nationalists subsequently achieved coincided with their opportunities to employ their air superiority as a tactical lever in loosening the defense of key positions which offered a well-defined target. Entrenchments in the mountains were far more visible from the air than those situated in valleys or plains. And the Basques were almost entirely lacking in either aircraft or antiaircraft artillery with which to counter the threat overhead.

Systematic air bombardment is hard to endure if there is a lack of direct countermeans, especially where the troops exposed to it know that their resistance on the ground does not suffice to cover their homes and that their families are suffering a similar bombardment which they can do nothing to check. Air power as exploited against the Basques revived in a new way the "dual stretch" of the combatants' instincts which broke down the resistance of the Confederate forces some seventy years ago when Sherman made his back-door entry into the South and cut a swath of devastation through Georgia and the Carolinas.

A FURTHER asset which the Nationalists and their foreign allies used with marked effect in the Basque campaign was the concentration of artillery fire—as many as 200 guns on a 1½-mile sector—to blast a hole at a particular point where it was desired to drive in a wedge, thereby loosening the general front of the defenders. If such a volume of fire was an indication of the extent to which their artillery had been reënforced from foreign sources, the concentration was facilitated and enhanced through the way it was made a complement to the air bombardment. Its greatest effect was achieved when the Basques fell back on their so-called "Iron Ring" close to Bilbao, a line whose strength without depth was its weakness. In contrast to the difficulty which the Nationalist artillery had met during the time of the Basques' maneuvering withdrawal, they were now presented with a fixed and clear target, while the moral effect on the defenders, when a hole was punched in this line which had seemed so strong, was all the greater because the troops on the flanks of the breach felt themselves suddenly "at a loose end," deprived of the firm pivot on which they had been made to lean too heavily. Lack of elasticity made the defensive dispositions brittle. It was a lesson of wider significance, confirming the experience of the last war and showing that the best defense is the mobile form rather than the more obvious one of taking up or falling back quickly to occupy too-obvious positions. Even in 1918 the Hindenburg Line proved less formidable and the Germans' subsequent series of rear-guard actions more formidable than expected.

The capture of Bilbao was followed after a short interval by the advance on Santander, another objective where the defense was handicapped by lack of room for a maneuver in retreat within the narrow coastal strip, as well as by lack of means to nullify the attackers' main weapons. To these now was added the use of tanks on a larger scale and with more effect than ever before in the Spanish war. The high ratio of machine power to man power was a significant feature of this offensive. According to report, the attackers used five small infantry divisions, totaling about 5000 men each, but with them were employed about 200 tanks, nearly as many fighting and bombing aircraft, and artillery numerous enough to concentrate 18 batteries on the front of a single small division, with apparently a similar quantity supporting others. A reduction in the size of the division, in order to make it easier to handle, is a reform long overdue in our own Army, where the ratio of the breach-making arms—aircraft, artillery and tanks—to the infantry is much lower than that seen at Santander. The operations here were the first clear triumph of the offensive during the Spanish war, although recognition of the fact has to be qualified by recognition of the defenders' weakness. This success suggests that raising the ratio of machine power offers the only chance of successful attack, if it does not justify the assumption that this will prevail against a defender with similar equipment.

THE influence of the tanks on the rapid progress of the Santander offensive confirmed the oft-expressed view of their protagonists that their effect would depend on employing them in quantity and that such use would bring results in far more than arithmetical proportion to their increased numbers. In the earlier part of the war, especially on the Madrid front, the comparative few which were available were often used in a way that repeated the errors of 1916 and 1917, being frittered away in driblets against points which were more dangerous than important. The proportion of losses they suffered was accentuated because they were obsolescent types of poor obstacle-crossing capacity and were too thinly armored to meet modern armor-piercing weapons. The types of tank sent to Spain had, at the most, barely twenty millimeters of armor, while the German 8-ton tank had less. And with this last machine it was found that it formed so unstable a gun platform that its fire effect was practically nil unless it slowed down—thus becoming an easier target.

Antitank guns, if not as numerous as they would be in the armies of the great powers, were more numerous than the

tanks—being easier to ship. Thus, when it was possible to gain warning of an impending tank attack, sufficient antitank guns usually could be hurried to the threatened point to ward off the danger by destroying or at least immobilizing the tanks. But the deduction has been drawn by some foreign observers from experience in Spain that as an adequate assurance against the risks of being surprised, it is necessary to have one antitank gun for every 200 yards of front even in open country that offers the tanks little chance of approaching under cover. Antitank mines do not appear to have been tried seriously, owing to the immense number needed on such extended fronts and to the lack of trained engineers. But there has been some effective use of concealed "catch" trenches with steep sides as a protection against, and a trap for, the lighter kind of tank. On the other hand, attempts to break up tank attacks by air bombing have had little success.

In the air itself, a much-remarked feature of the first year of the war was the increased speed of the lighter types of bombing machine in relation to the fighting machine, and the way that this, in combination with the former's increased armament, reduced the old advantage of the latter. While large bombers often have suffered from the attacks of fighters unless strongly escorted, the lighter multiengined bombers have been able to take care of themselves. But increased speed, both of fighter and bomber, has carried its own antidote. Higher landing speed has led to many crashes and given to improvised airdromes a danger nullifying their value. Higher speed in the air has offset the improvement of bomb sights and diminished the accuracy of bombing, owing to the fact that the bomb has to be released before the aircraft is over its target. As a result it was found that targets less than 500 yards long and 150 yards broad rarely were hit. Attempts to destroy bridges or to put individual batteries out of action failed even when the attacking machines came down to heights of less than a thousand feet, while attacks on fortified positions only have taken effect where these were clearly defined and the bombing formations could operate undisturbed. It has been against large targets, such as towns, that the results have been most marked, although even in such cases the actual point hit within the area has been largely a matter of chance. Night bombing has proved more inaccurate.

While antiaircraft artillery, even with the most modern types of German guns handled by their trained German crews, has not been able to score many hits, its presence covering the objective of an air raid would seem to have been a powerful deterrent in numerous cases, and, even where the raid has been pressed, to have contributed much to the nullification of the effect by disturbing the bomber's aim. Raids often have gotten through in the face of antiaircraft defense both from the ground and in the air, but important results have been rare except where the defense was scanty.

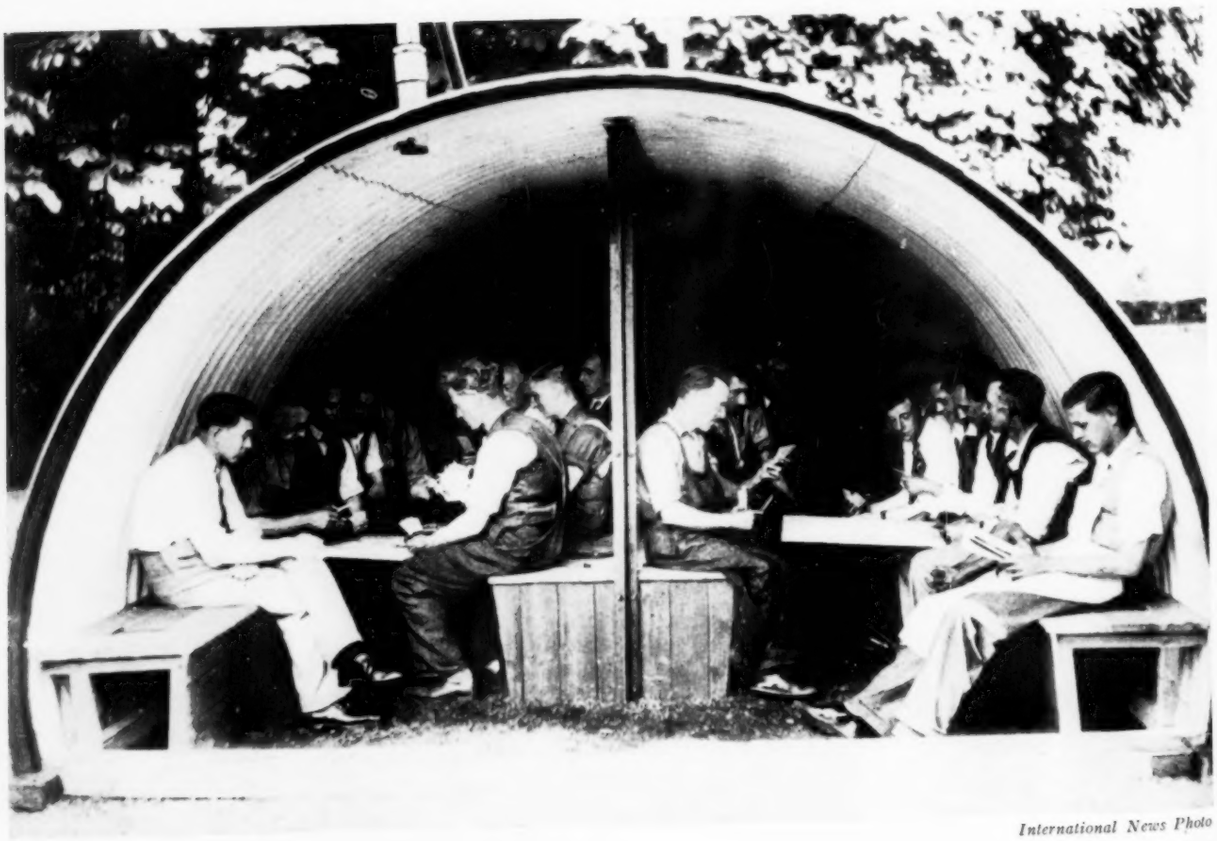
But aircraft, in their turn, have shown that they can upset the effectiveness of ground defense against ground attack. And it has been found that this moral effect on the defenders is enhanced by the confidence inspired among attacking troops when their advance is covered by a cloud of supporting aircraft, whereas they are apt to hang back if they themselves are threatened by enemy air attack. As a demoralizing agent, the development of air power has proved both insidious and pervasive owing, above all, to its uncertainty of time and aim. It carries the effect of long-range artillery fire a step further in producing the feeling, progressively depressing, that skill and courage are of no avail against a weapon that strikes haphazardly.

IN general, the experience of the war in Spain has given cause for more encouragement than discouragement to peaceful peoples. While due allowance must be made for the small scale of the air forces engaged there in comparison with those which a general European war would produce and for the handicap of inadequate ground organization, it is justifiable to draw two provisional conclusions: first, that air bombing tends to follow the general course of experience with past weapons and to prove less overwhelming in fulfillment than in anticipation, in practice than in theory; second, that while defense is not yet on equal terms with attack in the air, the deterrent influence of its presence is far more powerful than its actual effect, while the effect attained by the attack decreases disproportionately with the multiplication of defensive means. Pilots as well as peoples are susceptible to psychological stresses.

On land, the experience of the war has strongly supported the evidence of the World War that the defense is paramount at present. This has added significance because relatively small forces in vast areas offered the attack more scope and a better chance than it had on the closely packed Western Front. There have been a few successes gained merely by maneuver. But offensives by either side in general have had small effect in proportion to the loss of life. And even when a local moral breakdown momentarily has cleared the attackers' path, experience again has confirmed that of the World War in showing that conditions set a term to their powers of exploiting it. In taking the offensive, each side was embarking on a venture whose tactical foundations were unsound and whose slender chance of any great effect lay in the psychological sphere—in the possibility that the opponents might be ripe for a moral collapse. Otherwise a heavy sacrifice of life with little to show was the probable result. The original circumstances of the campaign, a military revolt against the Government, compelled General Franco to adopt an offensive strategy if he was to attain his aims; the extent to which his forces have pursued the offensive tactically, would seem to have been more avoidable and more dangerous to his cause. Hitherto it has brought a profit only where he has been able to concentrate a great superiority of bombers, guns, and tanks against an isolated section of the opposition which has lacked the means to combat them as well as the depth of ground to avoid them.

On the other side, the contrasting circumstances of a Government without an army helped to produce a wiser tactical course, and this long was maintained. Its abandonment by the Government in February 1937 may be traced to later circumstances which were too strong for restraining calculation. Raw troops and mass levies are apt to lose morale when kept to the defensive, though it may be well suited to their conditions tactically; even trained forces may falter if thus restrained unless they have been carefully taught that the highest art of soldiership lies in utilizing the advantages which fire-defense and calculated withdrawal offer for entrapping the opponent. None the less, the side which nowadays pins its hopes to attack, courts the risk of undermining its own troops' morale in the effort. That risk has matured first on one side and then on the other.

Bombproof Gas Shelters



International News Photo

Civilian Gas Defense

Protecting the Population from Aërochemical Attack

By Augustin M. Prentiss*

THE advent of military aviation and chemical warfare have brought about far-reaching changes in the scope and character of modern war. It now generally seems agreed by military experts everywhere that battles will no longer be limited to the battle front but will be carried to vital industrial communities in all parts of the home territory of each belligerent. This extension of the theater of operations brings up new and vastly more complicated problems of national defense, the almost endless ramifications of which will affect the daily life of every individual in the population. Now that aircraft are able to lay down effective concentrations of toxic gases over densely populated communities with almost no warning, it is imperative that each state take steps in time of peace to provide adequate means for protecting its population against this serious menace.

The time-honored tactical principle that the best defense is a strong offense is no longer valid in the case of chemical warfare, particularly in respect to the civil population, since no amount of air superiority can prevent a determined enemy from pushing home attacks on cities under cover of darkness. Indeed, in chemical warfare the best defense is not offense, but suitable and adequate chemical protection. This is especially true as regards the civil population, for chemical warfare differs from other types of warfare in that it involves a definite defensive technique that has no counterpart in other methods of combat.

FIG. 1. IMPERMEABLE PROTECTIVE SUIT

During the past few years a great many grossly exaggerated and utterly unreliable statements have appeared in the sensational press concerning the horrors of aërochemical attack against civilians. Some writers even have asserted that a few gas bombs dropped on New York could wipe out the entire metropolitan population. It is needless to say that such stories are nothing but figments of the imaginations of sensation seekers and are without foundation in fact. Indeed, there are few military subjects that have been misrepresented so grossly and are understood so little as chemical warfare.

While these lurid accounts of the terrors of aërochemical warfare are not to be taken seriously, we cannot afford to err in the other direction and ignore this menace altogether. When carefully analyzed, there is no doubt but that it is sufficiently serious to warrant the united efforts of all the agencies of Government —national, state, and local— to insure the people against the real dangers involved. Whole populations cannot be armed to counter air attacks as they can to repel invasions by land, but they can be equipped and organized to protect themselves when subjected to attack from the air. This is the problem of passive defense.

For the purpose of passive defense the population is divided logically into two parts—the active civilians whose occupations require them to carry on their duties when subject to air attack, and the passive civilians whose occupations may be suspended during the attack and who may either leave the attacked area or take shelter in the most available protected places. In Europe, where the subject of passive defense has been most intensively studied, it is estimated that the active civilians constitute about one-tenth of the whole population. For these, the government, either national or local, assumes the burden of providing the means of protection, but for the passive civilians, the burden of protection falls upon private industry and the individual himself.

CHEMICALS may be disseminated from aircraft by means of drop bombs and sprays. In bombs, all types of gases may be employed, while for sprays only the persistent gases, such as mustard gas, can be used successfully. The chemicals which may be employed by aircraft against civil populations are of three general types: the lethal or deadly gases, such as phosgene; the vesicant (blistering) gases, such as mustard gas; and the irritant gases, such as diphenylchlorarsine.

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The lethal gases are, as a rule, nonpersistent and attack the lungs and breathing passages. They will produce death after a few minutes exposure if breathed in sufficiently large quantities. The vesicant gases are generally persistent and attack all surfaces of the body, both exterior and interior, with which they come in contact. These gases are extremely penetrating and easily pass through ordinary clothing, leather, and even rubber garments. The irritant (arsine) gases are not true gases, but extremely fine smokes and fumes. These smokes are composed of exceedingly minute particles with an average diameter of less than 0.0001 mm. which float in the air as if they were in colloidal suspension. For this reason, they are often called "colloidal smokes." Being solid particles, they do not react with charcoal and other gas absorbents and can, therefore, only be removed from the air by the finest mechanical filters. For this reason the arsines are one of the most difficult classes of chemical agents to deal with in the problem of protection.

For protection against warfare gases two general methods are employed: individual protection and group or collective protection. For individual protection, gas masks and protective clothing are utilized, while for collective problems, gasproof shelters must be provided.

FIG. 2. BRITISH CIVILIAN MASK

In order to reduce the enormous cost of providing masks for the whole civil population, most European countries employ three grades of masks. The most expensive mask, which affords the maximum protection under the most adverse conditions, is the military service mask used by the army, navy, and air forces. This mask protects the eyes and lungs against all known war gases and allows the wearer the freedom of movement and general use of his faculties which are essential to the efficient performance of his duties. The military service mask usually is supplied to civilian personnel actively engaged in the passive defense of the community and whose duties require them to remain and work in a high concentration of gas; *e.g.*, police, firemen, decontamination squads, medical and sanitary personnel, etc. This mask generally is of the carrier type and consists essentially of a canister filled with materials to filter and absorb the gas, a facepiece to cover the eyes, nose, and mouth, and a flexible air tube to connect the facepiece with the canister. Fig. 3 shows our Army service mask which is typical of this type.

A less-expensive mask, constructed on the same general principles as the military service mask but simplified to reduce cost, generally is supplied in European countries to civilians officially engaged in the passive defense of the civil population and to workers in vital public-service activities who may be called upon to carry on their normal duties in the presence of gas, but who are not likely to be continuously exposed to high concentrations. This mask also is usually of the carrier type.

For the remainder of the population (the passive civilians) who need only a limited amount of protection until they can leave the vicinity of the attack or seek refuge in a gas shelter, a large variety of cheap masks are manufactured by private enterprise in European countries. These masks generally are of the snout type, as shown in Fig. 2, and are designed to meet the minimum technical requirements prescribed by the government at the minimum cost. The government requires that such masks officially be approved for sale after passing the required tests.

In addition to the types of masks just mentioned, special masks for the protection of babies, sick and wounded patients in hospitals, and others who could not wear any of the ordinary types of masks also are on sale.

AS already has been stated, vesicant gases, such as mustard gas, attack all surfaces of the body even through ordinary clothing; hence for those who must be exposed to such gases for an appreciable time the protection afforded merely by the mask is not sufficient. It is necessary to furnish such personnel with specially treated protective clothing which the gas cannot penetrate.

Various materials are utilized for this purpose, the prevailing type being cloth treated with certain drying oils such as linseed oil. A complete protective suit generally consists of an oil-treated cloth coat, trousers, hood, gloves and specially treated leather shoes (Fig. 1). Such a suit will protect the wearer against liquid mustard gas for several hours, even in hot weather. However, owing to the nonporous nature of the oil-treated cloth, the heat and perspiration from the body cannot escape and are retained inside the clothing, so that two hours is about the maximum time such a suit can be worn in hot weather without exhaustion. For this reason personnel wearing such protective clothing only can be worked in short reliefs not exceeding two hours.

Protective suits are issued to special personnel engaged in decontamination work after a mustard-gas attack and to others whose duties require them to work in areas where they are liable to come in contact with liquid mustard gas or a high concentration of mustard vapor that would penetrate ordinary clothing. In some countries, such as Germany, a light oil-treated cloth cape also is manufactured for sale to civilians, generally as a protection in case they are caught in the open during an air raid and subjected to mustard spray.

While it is possible to provide masks and protective clothing for every individual in the entire population, as now is being done in England, this does not completely solve the problem of passive defense. Aside from the fact that masks and protective clothing cannot be instantly available for every man, woman, and child at all times, there is a limit to the time they can be worn and they necessarily must be removed when eating and drinking, etc. Moreover, for some types of work, masks and protective suits cannot be worn at all.

TO take care of those situations where individual protection cannot be employed, it is necessary to provide collective protection. In principle, the means employed to obtain this protection is quite simple. It consists essentially of an inclosed space from which the outside air is excluded by maintaining within the space a slight superatmospheric pressure by means of purified air pumped in through a chemical filter. The inclosed space may be one or more rooms in an existing building, usually in the basement below ground for addi-

tional protection against high-explosive bombs and shells, or it may be a specially constructed shelter, not a part of any existing building, for the use of the general public. Gasproof shelters which have been constructed in Europe vary all the way from a single small room for a private dwelling to large underground public shelters capable of accommodating several thousand persons at one time.

For an air-raid shelter to be gasproof, it must be practically air-tight and have an independent air supply in proportion to the number of occupants to be accommodated. The limiting factors which control the maximum numbers of occupants are: (1) floor space; (2) volume of the room; (3) surface of the walls; (4) percentage of water vapor; and (5) temperature of the air. These last two factors are very important, as an air raid may last for several hours, in which case the shelter must be occupied for long periods.

It is essential that the air pressure inside a gas shelter be sufficient (about 10–15 mm. of water) to prevent the infiltration of gas through the masonry or any accidental source of leakage. Special air-tight doors fitted with rubber strips are used to prevent air leakage and to maintain the required pressure which is regulated by special exhaust valves. To completely isolate the gas shelter from the exterior, a combination of air locks, comprising two or more air-tight doors, is installed at each entrance. By proper ventilation these air locks also may be used as decontamination chambers for entrants who have been contaminated with gas.

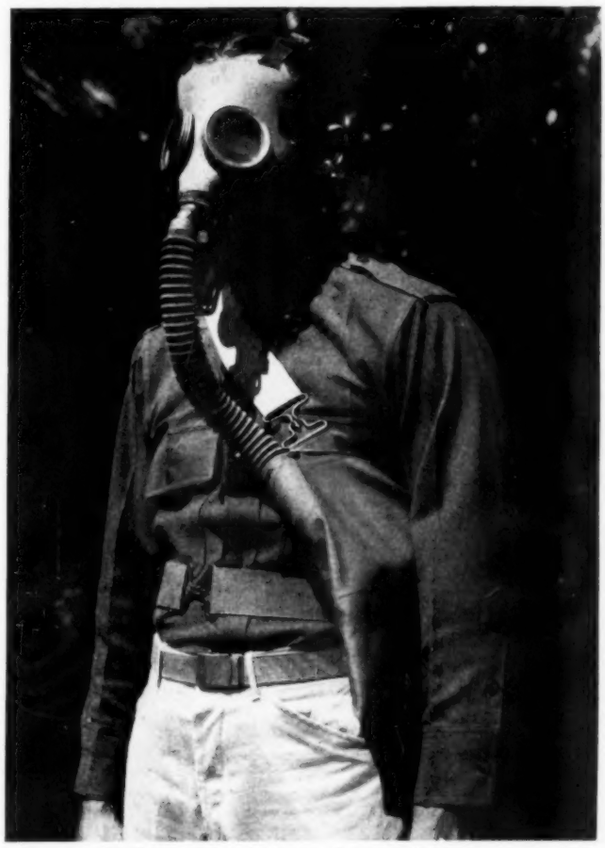

FIG. 3. U. S. ARMY SERVICE MASK

The minimum quantity of air required to support life comfortably within a closed room has been determined carefully by extensive physiological tests. Depending upon the degree of purity considered essential, this quantity is variously fixed at from one-half to one cubic foot of pure air per man per minute. The required quantity of air is obtained by a suction fan which draws outside atmospheric air into the room through a chemical filter constructed on the same principles as a gas-mask canister. The air is purified chemically by means of activated charcoal and physically by means of a large-surface, nonhygroscopic, low-resistance filtering medium which consists essentially of a specially treated paper filter. Fig. 5 shows a diagrammatic arrangement of a typical gasproof shelter which can be installed in any inclosed space that can be made sufficiently air-tight.

Fig. 6 shows a diagrammatic arrangement of a typical small-scale air-purifying and ventilating apparatus used in shelters designed to accommodate from one to twenty-five persons. It will be noted that the power for operating the fan is furnished by a bicycle drive operated by one man. Similar machines are built for operation by from two to four men and have a capacity of about twenty-five persons per operator. Beyond a capacity of 100 persons, the fans are motor driven, the largest unit designed to date having a capacity of 8000 persons.

The filters for purifying the air generally consist of one or more compartments containing activated charcoal connected in series, with a compartment containing the smoke-filtering elements consisting essentially of specially treated paper membranes arranged in a series of concentric folds to afford maximum superficial area. The standard filters are built up on the multiple-unit system, the basic unit being a filter with a capacity of fifteen cubic meters of air per hour (8.75 cubic feet per minute). This unit contains about five pounds of activated charcoal and has a total gross weight of about eight pounds. The largest installation made to date is in the Paris subway (Place des Fêtes) where there are installed 166 filters having a total capacity of 8000 cubic meters of air per hour which is sufficient for 4000 persons. Fig. 7 shows the successive air locks in the entrance to a gasproof London subway station capable of protecting 8000 people.

WHERE gas shelters are intended to protect vital governmental and industrial activities, such as government offices, telephone exchanges, essential municipal utilities, etc., it is imperative that these activities be able to carry on under the most adverse conditions. This necessitates provision for regenerating the air in such shelters to provide against failure of the air intakes from the outside atmosphere in the event of destruction by high-explosive bombs.

The air-purifying and circulating systems in such shelters are accordingly equipped with air-regeneration units which comprise means for absorbing excess carbon dioxide from the air in the shelter and adding sufficient oxygen to replace that consumed during the period of occupancy. The filter for the removal of carbon dioxide consists of a series of superimposed, shallow, horizontal trays, each holding a layer of soda lime about three inches thick and each capable of being selectively removed for replenishment of exhausted soda lime. An indicating device is attached to each filter to determine when the soda lime is nearing exhaustion. Additional oxygen is added to the air in the shelter from a bank of cylinders in which it is stored under high pressure.

A gas shelter equipped with air-regeneration apparatus is

Fig. 4. Gasproof Shelter for Ten Persons

capable of sheltering its rated capacity of occupants for a period of from twenty-four to forty-eight hours. This is considered sufficient to protect against the most prolonged war-gas concentration that could be maintained by an enemy attack. Fig. 4 shows the interior of a small gas shelter for ten persons, equipped with air-regeneration apparatus. This was the first gasproof ventilated shelter in London.

In addition to providing the necessary material for individual and collective protection, the schemes of passive defense now being developed in Europe comprise a far-reaching organization of the entire population of each country. Beginning with the national government and extending down to the smallest communities, a program of organized action for each echelon has been worked out in detail and prescribed in regulations and ordinances which in many of the countries are mandatory.

A typical illustration of the manner in which the civil population is being organized for passive defense is afforded by the present situation in England where local schemes for passive defense provide for the following precautionary services, insofar as they fall within the jurisdiction of local authorities: (1) Treatment of casualties; (2) Rescue work and demolition of unsafe buildings; (3) Decontamination of material; (4) Augmentation of resources for repairs of roads, sewers, etc.; (5) Air-raid wardens; (6) Fire-fighting organization; (7) Gas detection; (8) Emergency communications; (9) Protection of the public (*i.e.*, persons caught in the streets during raids); (10) Protection of public buildings and utility undertakings which are under the control of the local authority; (11) Lighting restrictions; (12) Air-raid warnings.

The Air Raid Precautions Department of the Home Office (abbreviated A.R.P.D.) is charged with supervision of the passive defense of the civil population and provides inspectors to visit local authorities for consultation on points arising in the preparation of local schemes of defense. For the handling of casualties in air raids, an Air Raid Casualty Service will be set up by local authorities to provide an organization for first-aid, casualty-handling hospitals and base hospital, ambulances, and similar services. An A.R.P. memorandum describes how local authorities can set up the organization for first-aid parties, first-aid posts, casualty-clearing hospitals, base hospitals, ambulance and other ancillary services.

The Air Raid Precautions Department is making arrangements for giving instructions to doctors and nurses in anti-gas precautions and the treatment of gas casualties. Practical instruction is furnished in A.R.P. Handbook No. 2—"First Aid for Gas Casualties" (2nd edition)—describing first-aid treatment; and A.R.P. Handbook No. 3—"Medical Treatment of Gas Casualties"—a clinical textbook for doctors and nurses. A.R.P. Memorandum No. 2—"Rescue Parties and Clearance of Debris"—indicates the organization and equipment required for the rescue of persons trapped in damaged or collapsed buildings and for the support or demolition of such buildings. Instructions on the organization of a decontamination service, are contained in A.R.P. Handbook No. 4—"Decontamination of Materials"—which outlines the type of organization required, gives detailed information regarding the equipment needed, and describes the processes of decontamination for streets, buildings, vehicles, and plants.

Plans for augmenting resources for repair of roads, sewers, etc., are to insure that it will be possible to have available in time of war the men and material to repair extensive damage due to air attack. The local authority which organizes the present service is in the best position to judge how this can be done. It should be considered whether normal resources would be adequate to deal with the damage by bombs affecting a number of roads and the services under them and if not, what supplementary arrangements could be made.

THE organization of a system of air-raid wardens is in process. The duties of air-raid wardens are to assist the

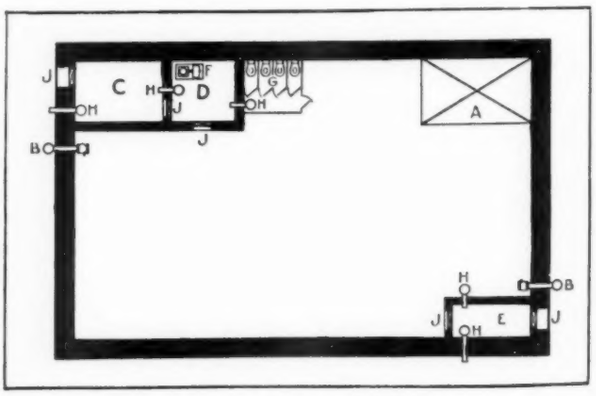

Fig. 5. Small Gasproof Shelter

(*A*) Filtration and ventilating apparatus; (*B*) Fresh-air inlets to filters; (*C*) Decontamination chamber; (*D*) Main air lock; (*E*) Emergency air lock; (*F*) Emergency lighting set; (*G*) Lavatories; (*H*) Evacuation valves.

public during air raids; *e.g.*, to help them to find alternative shelter if they are driven from their homes. They also will be used for reporting the fall of bombs and the damage caused thereby. An important duty will be that of dealing

with incipient fires, so as to relieve the fire brigades of the duty of attending fires which do not require large appliances. Personnel for this service will be volunteers. Fire brigades are being organized to meet, *inter alia,* the danger of air attacks in which incendiaries are employed.

It will be necessary in most urban areas to have available persons who are skilled in the detection of poison gas. Arrangements are being made by the British Government in coöperation with certain societies and associations for the recruitment of this service. It is at present contemplated that these officers should be attached to the police.

The telephone obviously must play an extremely important part in any air-raid-precautions organization. It is, however, possible that existing communication systems might be damaged and even put out of action; hence it is essential that plans should be prepared for the use of alternative means in order to prevent any area from becoming isolated for a considerable period. For this purpose it might be necessary to rely on a system of dispatch riders or runners if other means of communication were not available.

The Home Office is considering how best to provide for the protection of persons who are caught in the street when an air-raid warning is received, or whose houses cannot readily be made gasproof and splinterproof. A handbook on "Air Raid Precautions in the Home" is in course of preparation and will give advice to the general public as to what to do before, during, and after an air raid. Local authorities are examining what measures are required for protecting public buildings and for maintaining public utility undertakings (*e.g.,* electricity generating stations) and other public services, such as sewers and mains, which may be controlled by the authority. The Government has under consideration the question of the degree of darkening which would be required in different parts of the country, and its proposals will be communicated to local authorities in due course. Detailed arrangements are being made for conveying warnings of air raids by utilizing all available means.

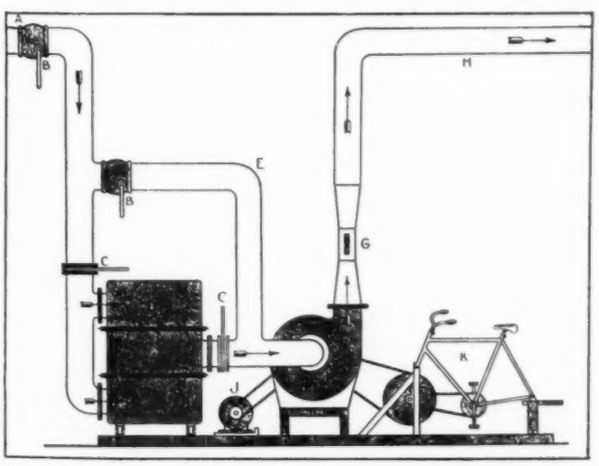

FIG. 6. SMALL-SCALE AIR PURIFYING APPARATUS

Single-operator type; 25-person capacity. (*A*) Fresh-air inlet; (*B*) Gas-tight valves; (*C*) Sliding dampers; (*D*) Filter; (*E*) By-pass; (*F*) Fan; (*G*) Flowmeter; (*H*) Pure-air outlet to shelter; (*J*) Motor; (*K*) Foot-power drive for fan.

So serious is the problem of passive defense of the civil population in Europe today that each country is bending every effort to provide the essential means and organization of the people for this purpose. Vast sums are being expended in the manufacture of gas masks and other means of individual protection and in the construction of gas shelters for collective protection.

FIG. 7. ENTRANCE TO A GASPROOF LONDON SUBWAY

England alone now is engaged in manufacturing 30,000,000 gas masks with which to equip every man, woman, and child within her borders. France already has accumulated 8,000,000 masks for its active civilians, while Germany has on hand 7,500,000, and Italy 5,000,000 for the same purpose. Heavy expenditures also are being made in each European country and in Japan for gas shelters ranging all the way from a single room in a private dwelling, costing about $150, to large underground public shelters, each capable of accommodating several thousand persons at a time, and costing up to $100,000 apiece. In France, present plans call for the construction of fifty large public gas shelters in the subway system which it is estimated will cost $5,000,000. In Germany it is claimed that more than 500,000 gas shelters already have been provided for the passive civil population.

In addition to providing the material means for passive defense, each country is conducting an intensive campaign of educating the public as to the real dangers involved in aërochemical attack and what should be done by every individual to protect himself and to allay general panic during such an attack. Unless the powers and limitations of chemical agents are thoroughly known and appreciated by the man in the street, fear of the unknown will greatly magnify the terrors of gas.

So strong is the pyschological factor in gas warfare that many experts believe the ratio of the moral to the physical effect in this form of attack is as 100 to 1, instead of the Napoleonic ratio of 3 to 1. To forestall the possibility of panic is one of the primary objectives of the educational campaigns that are now in progress all over Europe.

Preparedness in England

A Study of Industrial Moblization, II

By L. A. Codd*

ONE cannot write about armament—whether it be armament in England or the United States or Timbuktu—without first spiking a double-barreled myth. One barrel emits the charge that armament is a direct cause of war; the other sends forth the smoke that whoever makes armament is a war monger and a profiteer! The armament myth, both barrels of it, is nonsense and worse—it is deceit. A more monstrous barrage of pink poison has never been fired at shallow-thinking people. I use the word "poison" not as an epithet of abuse but with a full realization of its accuracy as applied to a nation's security.

THIS is the second in a series of articles on industrial mobilization in England. The preceding article undertook to present to readers of this journal an analysis of the broader phases of the British program; viz., rearmament for present defense needs and planning for her future war potential. The author described the principal organizational steps for military defense beginning with the Committee of Imperial Defense, the Minister for the Coördination of Defense, the Directorate of Munitions Production. These and other organizational bodies will be referred to frequently in the remaining articles of this series. Beginning in this article, the policies adopted by these bodies will be discussed. The first of these will deal with contractual relations and profit control. Other articles, in complete series, will be published in succeeding issues.

It certainly is not necessary in these pages to try to catalog armament. Directly and indirectly armament is all-inclusive. Wheat may be a warlike store more potent than a bomber; manganese can be more strategic than machine guns; often egg beaters are as essential to defense as gas masks! England's rearmament program is proving these simple truths all over again. Her armament is being made, avowedly, not to wage aggressive warfare but to defend against it; not to cause war but, if possible, to prevent it. England's private industry which has enlisted so whole-heartedly in her present armament program is not war-mongering. Whatever else it may be, it is not a profiteer in any insidious meaning of that word.

England today, in the policies of her present program of armament, is not misled by the myth. She starts from the sound premise—the only premise—that her national-defense needs are the products of her private productive power. Today the defense power of any nation is no more and no less than the national industrial power. Put another way, England takes her stand with and places her dependence upon her private industry, the only stand any great democracy worthy of its salt can take—and remain a democracy. We in the United States have a preparedness maxim which runs: Exclusive maufacture of armament in Government establishments would fail in war and such a policy is, therefore, illogical in peace. England follows the same prescription. I propose in this article to describe the policies England has adopted in relation to private industry in her present peacetime effort and, later on, her policies for industrial preparedness for war.

We in the United States may have some difficulty in visualizing England's attitude toward those who are engaged in the production of armament for her defense services. The difficulty may arise from the fact that under our governmental regulations the attitude is not quite the same. England's attitude toward the hundreds of firms which are at work on the defense program is not one of arm's-length dealing; it is not a feeling of suspicion that an inventor or a producer has something to sell and therefore is a dealer in gold bricks; it is not a posture of good fellowship in time of trouble but here's-your-hat-what's-your-hurry when everything is serene. England's attitude toward England's industry is quite the opposite. Her policy is based on the uncontrovertable fact that England *is* her private industry, her agriculture, her labor—taxpayers all. When a job is to be done—such as her present rearmament on sea, land, and in the air—private industry and commerce can and will do it. Their resources will be depended upon, their effort will be utilized, and they will receive a fair return on that effort. Private industry can, will, and must do the job. Private industry *is* doing it on the following bases:

FIRST, the job. I indicated in the initial article of this series (ARMY ORDNANCE, November-December 1937, p. 143) that it is a 5-year job estimated to cost seven and a half billion dollars and possibly ten billion. It is now in its second year. Some detailed idea of the magnitude of the program may give a better notion than so vast a figure. The following figures relate to the program of the Army and the Air Force. The Navy program is proportionately large.

The total estimates for military armament for 1936 were $45,365,000; for 1937 they were $125,160,000. For general military stores in 1936, $15,110,000; in 1937, $15,560,000. For works, buildings and lands in 1936, $25,430,000; in 1937, $50,410,000. A breakdown of "warlike stores" gives even a better picture of the armament expenditure and of the relative importance of the several types of equipment. This breakdown for the current fiscal year is as follows: guns and carriages, $26,590,000; artillery ammunition, $36,655,000; small arms, $3,910,000; small-arms ammunition, $2,285,000; wheeled mechanical transport, $13,735,000; tracked mechanical transport, $18,125,000; antigas equipment, $4,230,000; searchlight, signal, and bridging equipment, $12,045,000; and miscellaneous stores, $7,585,000—a total of $125,160,000. In addition, funds are provided for "machine tools, etc." for manufacture of stores *other* than at the Royal Ordnance Factories (*i.e.*, in private plants) in the amount of $16,485,000.

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The proposed expenditures for the Air Force during the current fiscal year are equally impressive. The Air Force estimate for equipment, including experimental and research services, is $240,660,000 this year as against $151,700,000 last. Likewise an analysis of this figure for the current year is enlightening. For airplanes and spares, $145,000,000 is being spent; for armament and ammunition, $37,375,000; electrical equipment, $7,755,000; photographic and aircraft instruments, $7,345,000; mechanical and other transport, $9,375,000; experimental and research establishments, $2,782,000; inspection services, $3,030,000; development, including the cost of experiments and research on metal construction and aircraft accessories, $1,255,000; supplies, including raw materials, portable machine and hand tools and airdrome ground equipment, $9,425,000; balloons and hangars, $3,450,000; airship development, $62,500; and gasoline and oil, $13,800,000.

So much for a detailed analysis of the current year's job in terms of money. Sum it all up for Army, Navy, and Air Force by remembering that the total expenditure during the first twenty months of the rearmament program (to October 1937)—actual disbursements and contract obligations together—amounted to $1,440,000,000. The money unit is a fairly good gauge, in general terms, of what England's private industry, backed by her few Government arsenals and naval establishments, is being called upon to do.

LET us try to visualize the job from the viewpoint of armament to be produced. First is the naval building program upon which heavy expenditures are being made (and they will continue for the next few years). The reasons are, of course, that many of Englands's naval vessels are, or soon will be, overage and no vessels of certain types were built for a number of years following the World War. (An historical period which will, no doubt, be known in years to come as the age of collective insecurity!)

Only three of her fifteen capital ships are of postwar construction. Five of these ships (approximately $40,000,000 each) are under way. Her fifty cruisers will be expanded to seventy, of which fourteen now are being built. Originally she planned to build one aircraft carrier; this later was raised to two and plans are under way for two more. Reflected in costs, these plans mean that her average annual building expenditure for 1931-1934 of less than $60,000,000 rose to $250,000,000 and for 1937 it is still higher. Heavy expenditures also are being made to modernize existing vessels, both capital ships and cruisers, particularly in antiaircraft and ammunition stores. Naval personnel is being increased in numbers; new services are being provided in dockyards and other naval establishments; additional storage facilities for ammunition, fuel oil and other reserves are being built.

For the Army, four new battalions of infantry, two new tank battalions and other troops and the transfer of two divisions of the Territorial Army (similar to our National Guard) from infantry to antiaircraft are being provided. But reserves of equipment are the urgent need. Modernization and mechanization of field artillery, infantry, and all other branches are now in active progress. The production of motor transport and armored vehicles of all types is being accelerated. To quote from an official statement, "The requirements of modern war demand the accumulation of immense reserves of ammunition to cover the first months before productive capacity can be increased and the necessary arrangements for this provision are being made."

The mission of the Royal Air Force is "to provide an effective deterrent to any attack upon the vital interests of the country whether at home or overseas." To execute this mission, new air bases are being established including more than seventy-five training and other stations. The personnel of the Force has risen from 31,000 in 1934, to 50,000 in 1936, and it is much larger now. Large numbers of airplanes and engines with reserves sufficient to insure a first-line strength of 2100 on active service are being produced. On the theory that "the bomber always gets through" bombers predominate. There are five principal types with speeds ranging from 250 to 280 miles an hour. Development of new types is producing more efficient and at the same time more costly machines. Similarly, aircraft armament, bombs, and other ammunition, as well as reserves of fuel, are being accelerated.

ALL this is England's immediate armament job; most of it is the job of private industry. An important element in the execution of so vast a problem is the contractual relationship between Government and manufacturer. Is the contract which a producer receives from the Government a stereotyped document? The answer is no. England's rearmament program is not a stereotyped program. The very nature of the stores needed precludes any such procedure. Where competitive bidding can be employed it is used; where competitive bidding cannot apply, no effort is wasted on it. At the same time prudence demands profit controls. Both methods are followed simultaneously. Where a commercial product can be bought in the market at a fixed price it is bought that way. Where production costs are unpredictable there is no hesitancy in experimenting. During the first year of operation, nine per cent of the armament contracts with private industry for noncommercial ordnance matériel involved an expenditure of more than fifty per cent of the total costs. These contracts were placed by noncompetitive bid.

We always must remember the Royal Ordnance Factories in this connection. Like our Government arsenals they are centers for training personnel in the technique of armament production; they are also fact-finding yardsticks for production costs. It has been said with good authority that these Government arsenals, small though their production is for an emergency program, are accurate in the computation of manufacturing costs. Similar to our own Government arsenals for limited production, training of personnel, and establishment of production costs, they are unlike ours in that they are managed by civilians. The principal duties of the military personnel are in the fields of design, development, and inspection. Production is an engineering responsibility handled very much as any of our automotive producers would handle it under a qualified civilian works manager. The result is a less-changeable, more-continuing policy than our own. In any event the Government authorities know what the material and labor costs ought to be for the production of any given item of equipment.

One other notion must be kept clearly in mind. Representatives of Government are not bound by the crazy-quilt pattern interlaced with red tape with which many of us are familiar. Far too many people in the United States who have done business with the Federal Government live in fear of what the Comptroller General may eventually interpret a contract to mean either during the course of the contract or long after its completion. In England no such chances are

taken. England's Mr. McCarl (using the name of a talented and respected American gentleman as a symbol) has his say about the contract *before* it is signed and not afterwards. The resultant grief saving is as real as it is apparent. This important step is provided through the simple expedient of having a representative of the Treasury attached to the Contracts Directorate of the Munitions Production Directorate so that before a contract is signed and sealed any doubtful points are decided once and for all. A private manufacturer under the English system knows that the Government contract he holds is a bond which requires only faithful performance on his part. He does not have to worry whether it means more or less than that. Nor need he bother whether all the "whereases" are where they ought to be!

Thus I hope the picture becomes clearer in detail. It is a canvas of abnormal proportions. It discloses a program which demands a great volume of specialized armament. Specialization is required of private industry at a time when the armament firms which existed during and shortly after the World War had practically passed out of existence. When the program was begun there were only one or two private ordnance factories in addition to the Government plants. Production of special ordnance matériel was undertaken through the general engineering firms of the country, each of which was especially selected to devote a part of its production to this class of work. These private producers were called upon to produce equipment they had never made before (unless, perchance, the same firm may have existed in the World War when it gained some experience but of which it had little or none since).

Not only are the authorities in the position of requesting private producers to manufacture ordnance which they have never made before, but also these producers are asked to hold themselves in reserve for the same kind of production in case of emergency. This means that a private producer whose plant can turn out, let us say, 1000 shell bodies a week in full production is asked to provide, the Government bearing the cost, additional plant which will double or treble that output. Consequently private producers are being asked to do something they have not done before and also to create production facilities for war reserves.

OBVIOUSLY the element of cost and, directly allied to it, the element of profit both are involved. The British Government has specifically stated that there are to be no excessive profits, that costs are to be computed by examination of company books. With practically no exception, private industry in England has accepted these conditions of contract so that their books are open to the Government cost accountants and all information as to the cost of product is furnished.

This procedure involves an interesting kind of contract. The English have a word for it. They call it a "target contract." A target contract may be defined as one with a limiting maximum unit price for a small quantity of specified material to be followed by a larger quantity after cost and profit on the first have been computed, the second to be followed by a third contract after cost and profit on the second are computed. It is easy enough to understand why such a method was arrived at. If a fixed-price policy had governed, private contractors would have been in the position of undertaking a contract knowing very little about production and ignorant of ultimate costs. The private producer who, let us say, is making talking machines is ignorant of the processes involved in the production of artillery fuzes; his plant personnel must be schooled and taught; during such an apprenticeship quantity production costs are unpredictable. Thus a limiting price was agreed upon beyond which the unit cost could not go.

Meanwhile Government had its own check on costs both from previous experience with private industry and its own production in Government arsenals. There was a sufficient similarity in the matériel Government had been ordering or producing for many years as well as the experience of the armament trade and the experience of technical experts so that it was possible to say roughly what sort of difficulties the manufacturer might encounter. Thus, the limiting price having been negotiated and found to be reasonable, the private producer knew that he had accepted a binding condition as to the maximum—the actual cost to be ascertained from his books. This procedure means actually that the contractor puts himself in the hands of Government for the assessment of a reasonable rate of profit within the limiting price.

Such is the first target. The contract provides for a relatively small quantity of matériel. If additions to plant are involved or the acquisition of machine tools indicated, these things will take time, and production rates, much less costs, will depend upon actual experience. After trial and error both as to production and costs, profit can be computed. And then follows the second target contract which specifies a larger quantity than the first and on a more definite cost-production and profit basis. After this second contract is completed, costs determined and profit agreed, the third target contract for still larger quantities at more definite rates is entered upon. The first order is sufficiently large to provide quantity production; the second order is larger, and the third is larger still. Similarly, costs on the first order are high, on the second they are reduced and on the third they are standardized.

THE rate of profit allowed private producers who are at work on England's rearmament program is referred to as *X*. It cannot be referred to otherwise because it may differ for each producer. If the equipment purchased is a standard commercial product, the price of which is based upon competitive bid, then profit control is not necessary. Market price containing its element of profit prevails. But where the product is not a standard commercial article—as is the case with so much ordnance equipment—when the processes involved are unfamiliar and the time factor unknown, then the target contract applies and profit varies in proportion to the private capital employed on the contract. There is no rule of thumb about it except that a reasonable profit which today seems to be less than the normal profit of private industry is allowed. My own guess is that a profit of about five per cent is general.

The computation of profit also takes into account the percentage of the plant facilities required by the particular contract. If the procedure seems to be indefinite there are redeeming features in its favor. Progress payments are provided so that profit computations are usually decided on the final portion of the total contract. Overlapping is prevented between the Admiralty, Army, and Air Force by the respective directors of contracts in the three establishments. Expert cost accountants are in close touch with operations, and the profit controls, by general opinion, are satisfactory

and fair to the taxpayers, the Government, and the private producer.

It is apparent that in such a procedure as I have just described, profit on the prime contract is a mere matter of accounting. But the profits of subcontractors or sub-subcontractors with whom the prime contractor deals are not susceptible to such close supervision. The present policy is to observe costs of components carefully and if these prices are too high the Government itself may do the purchasing and furnish the material to the prime contractor, in which event the same methods of computing costs and profit apply to the component as those which govern the purchase of the finished article.

Let us take as an example an army tank. A main contractor for the assembly of the tank might not, and in many cases could not, manufacture the engine. If he received a contract for the completed tank the engines would be furnished him by a subcontractor so that possibly the most expensive element in the tank would not be subject to the profit controls of the prime contractor. Consequently the War Office contracts directly for the engines, the tracks, and the transmissions, and supplies these to the assembly contractor. If a saving to the taxpayer by direct purchase will result, that method is followed.

ALL this simplifies down to one or two first principles: If the product to be purchased is not special, that is, if it is commercial in natutre, it is purchased at the market price. If it is special, it is purchased at a maximum price subject to cost accounting and the determination of a reasonable profit.

For an American observer, the question naturally arises, "Are these profit controls effective and if so are they satisfactory?" The answer is that they seem to be effective despite their apparent lack of standardization; indeed they are probably more effective than a standardized procedure might be. England does not worship at the shrine of standardization as we do, and in some respects she is the better for it. The net result is demonstrated by the attitude both of Government and business. Government's attitude is one of fairness; business' attitude is one of coöperation. Both are honestly trying, first to rearm England and secondly to save the British taxpayer from any unnecessary financial burden.

But the point I wish to make particularly in this article is the one with which I began it. The point requires emphasis time and again. England today is an outstanding example that private industry is the backbone of armament production; that a country is only as strong as its ability to produce or procure the sinews of defense. Upon this thesis rests the whole case for industrial preparedness, and whether industrial preparedness means a mobilization plan such as we in the United States have adopted or whether it means the more informal procedure under which England is operating, it is clear that there must be private industrial production of armament in peace and in war.

England's philosophy on this point is worthy of full statement. Several years ago, in response to pacifist agitation, a Royal Commission was appointed in England on the private manufacture of arms. One of its recommendations was: "We further recommend that the Government's own manufacturing establishments should be fully equipped for the production in some measure of naval, military and air armament of all types." This recommendation was advanced by the Commission as a means of planning for rapid expansion in emergency, for the checking of trade prices in peace, and the elimination of the risk of profiteering in time of war.

In response to this claim the Government of England set forth its underlying policy of industrial preparedness. It called attention to the fact that the recommendation is already met to a considerable extent by the existing Royal Dockyards for the building of warships of all types, the Royal Ordnance Factories and other Government establishments for supplying in some measure a large proportion of the different types of arms used by the Army and Navy. But the Government was definite in its opposition to further dependence upon Government factories. Its creed is worthy of statement at length:

"They (the Government) feel, however, that if the recommendation is examined a little more closely, it will be seen that the reasons advanced for putting it (the recommendation for expansion of Government establishments) forward are by no means conclusive. The chief reason given is planning for rapid expansion in emergency. Recent experience shows, however, that this object can only be achieved by equipping a large number of private firms with the necessary plant, tools, jigs, and gages as part of a plan for industrial mobilization, in addition to the resources of Government establishments. It must be remembered that a great many items which would be required in large quantities in time of war are closely related from the manufacturing point of view to similar articles made by private firms in time of peace, and in such cases it is obviously advantageous to draw upon the large body of experience and capacity for output which such firms provide. . . .

"Another reason put forward for this recommendation is that State manufacture would furnish a check on the prices charged by private firms and thus tend to eliminate the risk of profiteering. His Majesty's Government recognize the value of the check obtained in this way through the operations of the Royal Dockyards and the Royal Ordnance Factories; but they desire to point out that modern accounting and technical costing methods which are being widely and increasingly applied to Government contracts have made it possible to obtain other checks of at least equal efficiency for the purpose in view. The setting up of additional state manufacture purely for this purpose, would, in the view of His Majesty's Government, not be justified.

"An important difficulty in the way of the adoption of this recommendation is that it would in many cases lead to unnecessary duplication of plant and thus to wasteful expenditure in capital outlay and maintenance on the part of the State and uneconomical production on the part of the private firms. For example, armor and heavy naval gun mountings require plant, a proportion of which is capable of use both for the manufacture of arms and for commercial work. The existing practice whereby these products are manufactured by private firms enables the same plant to be used for both purposes. If the State decided to set up separate establishments for the armament work alone, the maintenance of the increased number of plants would mean that the overhead costs, both for the State and for private industry, would be considerably greater than they are at present."

In the next article we will discuss England's plans for the future of industrial preparedness. And following that, in the concluding article of this series, some conclusions and analogies will be drawn as to how the United States might profit from England's experience. (*To be continued.*)

The Army's New Air Fighter

Designed to meet the speed and fire of the modern bomber, this new fighter, built by the Bell Aircraft Company, mounts two automatic cannon forward as well as guns in "blisters" on each side aft. It also is equipped to carry light bombs. The twin engines with propellers mounted behind the wing give the cannoneers an unusually clear field of fire. The ship has a top speed of over 300 miles an hour and a fighting ceiling of 30,000 feet. Wing flaps are provided to reduce landing speed and an auxiliary power plant relieves the load on the main engines. This latter feature also makes radio communication possible should the main power plants fail. Landing wheels are retractable and the crew compartments are electrically heated to protect the ship's personnel at high altitudes. These two views of the new fighter are from official U. S. Army Air Corps photographs.

Ordnance in the New Division

A Discussion of the Proposed Organization of Functions

By Raymond Marsh*

MUCH has been heard of late about the salient features of the Army's proposed new division. The War Department Board on Modernization of the Organization of the Army submitted its initial report on this subject to the Chief of Staff in July 1936.

Since that time, various publications have carried discussions of certain phases of the organization, operation, and services of the unit. However, little has been published as yet regarding *Ordnance service* in the proposed division. Notwithstanding the fact that this division even now is undergoing service test, it might not be amiss to point out how the new organization provides for Ordnance service therein and to venture a few personal opinions as to how the Ordnance facilities and agencies included therein might be organized and employed to discharge their prescribed missions.

THIS article is more timely than its title indicates. During recent months the proposed Infantry division has been submitted to a field test, the results of which now are being studied. Although a great deal has appeared in the public press in the nature of news stories and general discussions, little has appeared on the theories of supply as applied to this high-powered "streamlined" military organization.

The author of this article, having devoted many years to the analysis and operation of ammunition supply, is well qualified to present his views on the subject. The rising tide of mechanization, reduced man power, increased fire power, swift mobility, offensive and defensive maneuverability, and above all, consumption of supplies, warrant a thorough understanding not only of the possibilities but of the implications created by this new field organization. The Ordnance responsibilities which grow out of the above factors are of first importance and deserve a sympathetic attitude in order that munitions supply may be as efficient, as smooth, and as sure as the power of the unit undoubtedly will be.—EDITOR.

The accompanying chart shows that the proposed division has a war strength of 673 officers and 12,839 men and that it is divided into a command echelon, a reconnaissance echelon, a combat echelon, a service echelon, and attached personnel. The command echelon includes division headquarters, a Signal company, and an Engineer battalion, totaling 44 officers and 733 men. The reconnaissance echelon consists of only a reconnaissance squadron of Cavalry with a strength of 16 officers and 200 men. The combat echelon includes three unbrigaded regiments of Infantry and one regiment of Field Artillery, totaling 440 officers and 9486 men.

The service echelon with a strength of 95 officers and 1820 men includes, in addition to its own headquarters and headquarters company: the division band; a Quartermaster Corps motor battalion, light-maintenance company, and service company; an Ordnance company; a Medical battalion, and some attached personnel. The attached personnel of the division as a whole includes the Signal personnel attached to combat units, the Medical personnel similarly attached, and the chaplains.

From a survey of this chart and other data on the subject, the following outstanding features of this organization may be noted: 1. The combat organization is triangular, replacing the square organization of the postwar division. 2. The Infantry component includes only three regiments and the Infantry brigade and section are eliminated. 3. The Field Artillery component consists of one regiment of four battalions of three batteries each; three of these battalions each include two batteries of 75-mm. howitzers and one battery of 81-mm. mortars, and the other battalion includes three batteries of 105-mm. howitzers. 4. The Cavalry component, which constitutes the reconnaissance echelon, consists of a squadron of motorized cavalry. 5. The immediate supply functions, general service transportation, hospitalization and evacuation functions, and other service functions are allotted to appropriate service units which comprise the new service echelon under the designation of "service troops" and are commanded by a brigadier general of the line.

The effective armament of this organization includes 3996 semiautomatic rifles, 324 light machine guns, seventy-two caliber .30 machine guns, thirty-six caliber .50 machine guns, thirty-six infantry light mortars, thirty-six 81-mm. mortars, twenty-four 75-mm. howitzers, and twelve 105-mm. howitzers.

While infantry and artillery brigades have been eliminated, it is provided, as noted above, that the service troops will be commanded by a brigadier general of the line and that there shall be a brigadier general on the special staff of the division commander who shall serve as a tactical and training inspector, as an infantry adviser, and as general assistant to the division commander. He also will be available as a replacement for the division commander should the latter become a casualty.

The division commander's general-staff organization differs from the conventional set-up only in that the G-1 section is eliminated—the division adjutant general taking over the duties formerly performed by that section.

The special-staff organization, however, has been changed materially. It is prescribed only that the brigadier general assistant to the division commander and the division Signal officer shall be on the special staff and such other supply and service representatives as the division commander may desire. The Quartermaster, the Ordnance officer, the Surgeon, the Chemical Warfare Service officer, and the Finance officer have been shifted to the staff of the "service troops" commander where, with an Engineer supply

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officer and a Signal supply officer, they constitute the technical staff of the commanding general, service troops.

IN a statement made public in November 1936, the Secretary of War said, among other things, with reference to this new division:

"The new division is a marked departure in several directions from that which we now have. One of the main purposes which actuated its formation was the desire to remove from all organizations the so-called 'contingent' duties and supply. Instead of being prepared at the expense of large numbers of men and a great volume of material to be all things unto themselves, in the future all arms and services must trust one another to perform their assigned functions.

"The Ordnance Department will be responsible for ammunition supply to combat units.

"Acceleration of operation in open warfare requires that the number of command echelons be reduced to the minimum; that reconnaissance and security elements, motorized or mechanized, be provided for divisions; that the size of staffs, headquarters units, and service units be no larger than needed for effective coördination of combat and administrative functions; and that the certainty and speed of communications be increased.

"Economy requires that weapons, services, personnel, and equipment not always required, but needed only under certain contingencies, be pooled.

"The supply of the division will, due to the change in organization, be greatly simplified and accelerated. Combat supply and baggage facilities will, as heretofore, remain with the organization, but the organization of the service echelon will provide, through its motor transport battalion, for the supply of all ammunition and daily supply."

From an Ordnance viewpoint, probably the most important feature of this new organization is the vesting of the Ordnance Department with the responsibility for the supply of ammunition of all kinds to combat units of all kinds. This eliminates the artillery brigade ammunition train of the old division and sets up one ammunition supply system for all types of ammunition used in the division. It is also specified that, as far as practicable, this single, unified ammunition supply system should be based upon the "refill principle," which means that the division should carry in its service trains, as a reserve for its units, such quantities of ammunition as may be required to reload completely all the combat trains of the division.

BEFORE we take up in more detail the Ordnance agencies and facilities in this new division and venture a few ideas as to how they may be organized and operated, let us recall briefly what Ordnance agencies and facilities were provided in the old divisions, what their missions were, and how they were organized and operated.

In addition to such functions as pertain to the technical nature of the duties of a special-staff officer, Ordnance personnel in the old division had to perform functions of general supply, maintenance, and some phases of ammunition supply. And, of course, this included the associated functions of salvage, inspection, and repair, applicable to all of the three primary functions noted.

To perform these functions, division headquarters had two officers and one master sergeant in its Ordnance section, and in the division special troops there was one medium-maintenance company of 7 officers and 138 enlisted men of all grades. These are war-strength figures—T/O 2W and T/O 12W. At peace strength, one officer and one technical sergeant were authorized for the Ordnance section of division headquarters and the medium-maintenance company with an authorized strength of slightly less than fifty men seldom had more than one officer with it. It is to be noted that no personnel were provided to perform any functions other than those of maintenance and those pertaining to the position of a special-staff officer. The functions of general supply and those phases of ammunition supply for which the division Ordnance officer was held responsible had to be performed by personnel diverted from their primary function of maintenance.

It should require no argument to convince any one that a war-strength medium-maintenance company was barely large enough to perform properly the maintenance functions required by the matériel in the hands of the old twenty-odd-thousand-man Infantry division. Neither should it require any proof to establish the fact that an Ordnance section of but two officers and one sergeant in the old division headquarters was wholly inadequate.

Reference to the Ordnance section of division headquarters recalls another of those numerous and inexplainable contradictions of duties which are so easy to impose in tables of organizations and so hard to perform in reality. In T/O 2W it is provided in a note that one of the two Ordnance officers authorized shall function as division munitions officer. And yet in the Staff Officers' Field Manual, no mention is made of such an office. And of course no facilities are provided anywhere for the proper operation of such an office.

IN the proposed division, let us see what the Ordnance personnel has to do, what agencies and facilities are provided, and then may I be pardoned if I venture a few ideas and opinions as to how these agencies and facilities may be organized and operated to perform as well as may be possible their prescribed duties?

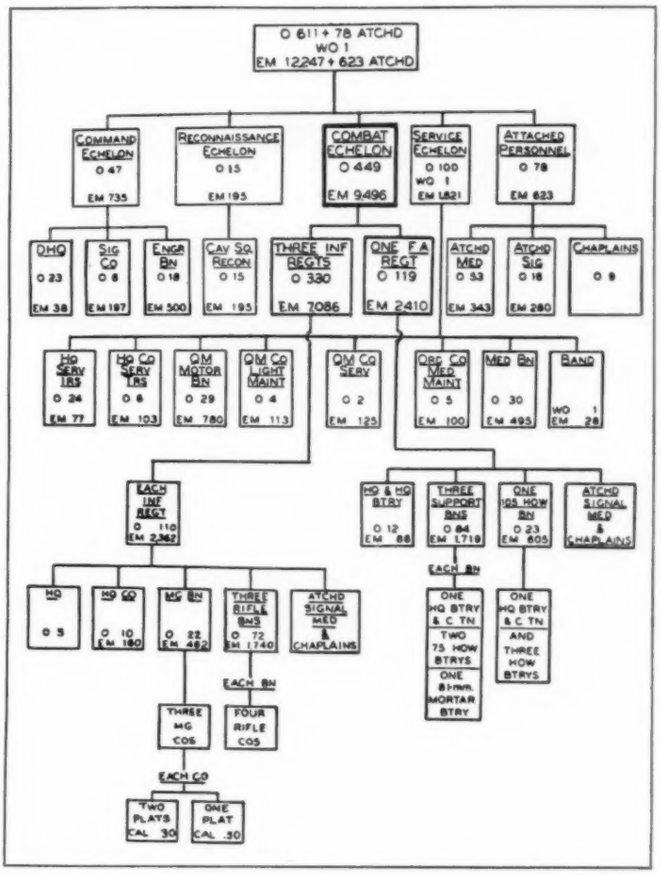
The maintenance mission is unchanged except that it is somewhat reduced in volume and variety because of the reduced size of the division, the elimination of tanks, and the substantial reduction in the matériel of the artillery component. The addition of the Ordnance matériel in the hands of the squadron of motorized Cavalry in the reconnaissance echelon is more than offset, from a maintenance viewpoint, by the reductions in the other echelons of the division.

Although not specifically mentioned thus far in public statements, it may be deduced from what has been said on the general subject of supply that the mission of Ordnance general supply is unchanged. Perhaps it is safe to say that this mission now is more generally recognized and accepted and it appears to be acknowledged that means must be provided to meet the demands for this service. The missions with reference to ammunition supply have been expanded, clarified, and made infinitely more definite. It is provided, it will be recalled, that the Ordnance Department will be responsible for ammunition supply to combat units, that there shall be one ammunition supply system for all types of ammunition used in the division, and that this single ammunition supply system shall, as far as practicable, be based upon the "refill principle."

Summarizing briefly then—in the proposed division Ord-

nance personnel, facilities, and agencies have the missions and functions of maintenance, Ordnance general supply, and ammunition supply for all types of ammunition used in the division.

To perform these duties there is provided in the headquarters of the service troops of the proposed division an Ordnance section consisting of 5 officers and 27 enlisted men on a war-strength basis and 3 officers and 16 enlisted men on a peace-strength basis. Included in the units comprising the service troops there is an Ordnance company (medium maintenance) of 5 officers and 100 enlisted men on a war-strength basis and 3 officers and 50 enlisted men on a peace-strength basis. This provides in the new division, on a war-strength basis, a total of 10 officers and 127 enlisted men, and on a peace-strength basis, 6 officers and 66 enlisted men—all Ordnance Department personnel. This compares with 9 officers and 139 enlisted men of the Ordnance Department in the old war-strength division, and 2 officers and 50 enlisted men in the old peace-strength division. This is a reduction in absolute numbers, but it is a material increase on a proportional basis. Particularly to be noted is the distribution of this Ordnance personnel in the proposed new Infantry division.


O 611 + 78 ATCHD
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COMMAND ECHELON O 47 EM 735
RECONNAISSANCE ECHELON O 15 EM 195
COMBAT ECHELON O 449 EM 9496
SERVICE ECHELON O 100 WO 1 EM 1821
ATTACHED PERSONNEL O 78 EM 623
DHQ O 23 EM 38
SIG CO O 8 EM 197
ENGR BN O 18 EM 500
CAV SQ RECON O 15 EM 195
THREE INF REGTS O 330 EM 7086
ONE F A REGT O 119 EM 2410
ATCHD MED O 53 EM 343
ATCHD SIG O 16 EM 280
CHAPLAINS O 9
HQ SERV TRS O 24 EM 77
HQ CO SERV TRS O 8 EM 103
QM MOTOR BN O 29 EM 780
QM CO LIGHT MAINT O 4 EM 113
QM CO SERV O 2 EM 125
ORD CO MED MAINT O 5 EM 100
MED BN O 30 EM 495
BAND WO 1 EM 28
EACH INF REGT O 110 EM 2367
HQ & HQ BTRY O 12 EM 88
THREE SUPPORT BNS O 84 EM 1719
ONE 105 HOW BN O 23 EM 605
ATCHD SIGNAL MED & CHAPLAINS
HQ O 5
HQ CO O 10 EM 180
MG BN O 22 EM 492
THREE RIFLE BNS O 72 EM 1740
ATCHD SIGNAL MED & CHAPLAINS
EACH BN
ONE HQ BTRY & C TN
TWO 75 HOW BTRYS
ONE 81-mm. MORTAR BTRY
ONE HQ BTRY & C TN
AND THREE HOW BTRYS
EACH BN
THREE MG COS
FOUR RIFLE COS
EACH CO
TWO PLATS CAL .30
ONE PLAT CAL .30

ELEMENTS AND STRENGTH OF THE PROPOSED INFANTRY DIVISION

Total personnel—officers, 673; men, 12,839. *Effective armament*—Infantry (three regiments): semiautomatic rifles, 3996; light machine guns, 324; caliber .30 machine guns, 72; caliber .50 machine guns, 36; light mortars, 36. Field Artillery (one regiment): 81-mm. mortars, 36; 75-mm. howitzers, 24; 105-mm. howitzers, 12.

In the old division, with its total war strength of 21,733, there were 2979 individuals, or 14 per cent, assigned to the services. In the proposed division, with a total war strength of 13,512, there are 2290 individuals, or 17 per cent, belonging to the services. The Ordnance Department has participated in this increase of service personnel. While the new division totals only 62 per cent of the old division, Ordnance personnel in this proposed division totals 93 per cent of the Ordnance personnel provided in the old division. With this picture of Ordnance missions and Ordnance means, how may we formulate Ordnance duties and how may we organize the means provided in order to perform these duties?

FIRST of all, the many changes incorporated in this proposed division suggest the desirability of revising that section of the Staff Officers' Field Manual pertaining to the duties of a unit Ordnance officer. For your consideration, let me suggest the following revised wording of that section, as pertains to the division Ordnance officer:

"Under the direction of the commanding general, service troops, the division Ordnance officer will: a. Command, insofar as relates to operations, the Ordnance troops not assigned or attached to subordinate units; b. Act as adviser to the division commander, the commanding general, service troops, and their staffs in Ordnance matters; c. Operate the ammunition supply service for the division as far forward as, and including, the operation of the ammunition distributing points; d. Operate the supply system for Ordnance general supplies and equipment; e. Operate the Ordnance storage, maintenance and repair facilities, including salvage of Ordnance matériel; f. Make, or cause to be made, the necessary technical inspections of Ordnance matériel in the hands of all units in the division; g. Supervise, within limits prescribed by the division commander, all Ordnance activities in subordinate units; h. Collect information concerning functioning of his own ordnance matériel and information concerning enemy ordnance matériel; i. Have custody of captured enemy ordnance."

Such a revised version includes all the missions of Ordnance service, and, I believe, covers adequately and properly the relations which, it seems, should exist between the division commander, the commanding general, service troops, and one of the principal service representatives in the division.

Under the organization of the new division, all Ordnance activities and units appear to be grouped under the command of the commanding general, service troops. And it further appears that these Ordnance activities and units will consist of the office of the division Ordnance officer, the office of the division Ordnance supply officer, and the Ordnance company (medium maintenance). And it still further appears that the Ordnance section in the headquarters, service troops, provides the personnel for the staffs of these two Ordnance offices and the administration and supervision of the supply systems which must be operated by the Ordnance in the division.

A division Ordnance office of one field officer as division Ordnance officer, one officer of company grade as assistant division Ordnance officer, and two enlisted men—one a

master sergeant, as chief clerk, and the other a competent clerk-typist—appears to be adequate. Such additional personnel as might be required as messengers, chauffeurs, etc., should be supplied, on request, from the headquarters company, service troops, or some other appropriate unit.

The division Ordnance supply office might well consist of one field officer as division Ordnance supply officer, two officers of company grade as assistant division Ordnance supply officers, five technical or staff sergeants (one each to ammunition, general supply, and maintenance service division in the office, and the remaining two as ammunition superintendents with the truck companies carrying the division's ammunition reserve), four sergeants as assistant ammunition superintendents, twelve corporals as ammunition foremen, two corporals as clerk-typists, and two privates with appropriate ratings as clerks. This office should supply the necessary administrative and technical supervisory control and personnel for the operation of the Ordnance supply system of the division, including both general supply and ammunition supply.

Under these suggested organizations, the five officers and twenty-seven enlisted men of the Ordnance section, headquarters, service troops, are distributed among and absorbed entirely by Ordnance activities. They should, of course, be Ordnance Department personnel and might properly be attached to, or included in, the tables of organization of the headquarters company, service troops.

THE Secretary of War, in the statement cited above, indicated that items, services, personnel, and equipment required only in contingencies would be pooled and that such pooling would include, among other things, motor and animal transportation, reserves of ammunition, and various service units. From this it may be deduced that since the only transportation units provided are the Quartermaster Corps units in the service troops, the transportation and the necessary labor for the operation of the Ordnance supply systems will be supplied by these units.

If this deduction is correct, then truck companies from the motor battalion will supply the necessary transportation for the operation of the ammunition supply service. The necessary labor for the operation of the ammunition distributing points, the loading and unloading of trucks, etc., will be supplied by the Quartermaster service company operating under the supervision of the noncommissioned officers indicated above as ammunition superintendents, assistant ammunition superintendents, and ammunition foremen. These noncommissioned officers, who should be trained ammunition men, will therefore provide the necessary trained administrative and supervisory personnel for the operation of such ammunition installations as the division will establish.

While all the general transportation of the division is grouped in the Quartermaster motor battalion in conformity with the idea of pooling, it appears to me that with reference to those vehicles engaged in the operation of the ammunition supply system, we might do well to take a leaf from the British Field Service Regulations and require that trucks normally employed in such service be not diverted therefrom except in the most unusual circumstances. The British say: "In mobile operations . . . . no lorries or other vehicles provided for the transport of ammunition should be diverted from their legitimate functions, except in very exceptional circumstances."

IN the operation of the general supply system, I believe it reasonable to contemplate that practically all requirements for individual equipment can be met from salvage from the battlefield. Such other items of Ordnance general supply as may be required in combat will be limited to items of organizational equipment. The nature of these items is such that practically none of them can be carried in reserve in a mobile status. It also may be contemplated that these requirements, in time of combat, will be relatively small. However, provisions should be made for the prompt supply of such of these items of organizational equipment as may be required.

By utilizing the personnel suggested for the office of the division Ordnance supply officer, I believe that prompt supply of these items may be effected by supplying a small detachment of this personnel with adequate transportation, and arranging that this detachment, upon receipt by the division Ordnance supply office of a request for the replacement of any item of organizational equipment, will proceed to the nearest authorized supply point for that type of matériel, procure the needed item, and either deliver it to the organization in need, or make arrangements for that organization to draw it or to be otherwise supplied, as, for example, on the daily train. The trained supply personnel from the office of the division Ordnance supply officer thus will furnish the necessary administrative and supervisory personnel in the actual operation of the Ordnance general supply system and, under the principle of pooling, the necessary labor and transportation would be supplied by the Quartermaster service company and the motor battalion.

Maintenance functions can be discharged by the maintenance company provided in the proposed division in very much the same manner as such functions were discharged by the maintenance company in the old division. This company should be charged solely with maintenance and repair functions, but it also should be provided that when necessary this company may issue such spare parts, etc., as may be available in the stock of such items authorized for and normally carried by this company.

To what extent the organization of this company may have been developed by the Ordnance Department is not known at this writing, but if experience is any guide, we may expect to see in the perfected company a company headquarters and supply section, a service section, an artillery section, an automotive section and an armory section very similar in organization, duties, and equipment to the comparable sections in the present Infantry division Ordnance maintenance company. Taking into consideration the reduction in the strength of this proposed division, with the consequent reduction in the amount of Ordnance matériel to be repaired and maintained, the proposed Ordnance maintenance company of five officers and one hundred enlisted men appears to be adequate.

It may be that even as these lines are being written, tests of this division in Texas are exploding some of the theories and suggestions presented above. It conceivably may be that in the field test of this proposed division some of these theories and suggestions are being applied as the results of studies made by others interested in Ordnance service. It is also conceivable that when the test is completed, results are being analyzed, and correction of observed defects considered, a few of these ideas may have some value and even, perhaps, find some application! They are theories presented as such.

The Adams Revolver

Colt's Closest Rival in the Percussion-Lock Era

By S. Basil Haw*

THE first two or three years of the 1850 decade marked an epoch in the history of the British gun trade—the introduction of the revolver as a practical commercial proposition. It would, however, be quite inaccurate to assume that it was entirely novel to this country, for successive generations of designers had, from the seventeenth century on, grappled with the problem of creating an efficient arm of this kind. Lack of technical skill and sufficiently accurate equipment, together with the unsuitability of the systems of ignition then in use, had hampered their efforts.

THE English "Adams" was the first solid-framed revolver to be placed on the market, the first to be fitted with a double-action lock and the first to be built on the general outlines of the revolver of today. During the muzzle-loading era it was the Colt's closest rival in world-wide popularity. It was also, as far as the author is aware, the only make of English revolver that was manufactured in the United States as well as in the country of its origin. Yet, strangely enough, there is no connected history of this famous arm in any existing work of reference. This article has been written to remedy the omission.—EDITOR.

It is very apparent that toward the close of the flintlock era they had more or less abandoned their experiments in this direction and had turned their attention—only casually, it must be admitted—to the rather crude multibarreled "pepper-box" pistol which made its first appearance, in flintlock, hand-rotated form, somewhere between 1780 and 1790. The invention of fulminate ignition in 1807 and the subsequent development of the percussion cap considerably enhanced the efficiency and popularity of the "pepper-box" pistol, but the revolver still remained comparatively neglected, despite the fact that the new form of ignition had brought with it the solution of the old problem of flash leakage at the breech.

At the same time, it must be admitted that both the military authorities and the general public showed little interest in the system. Elisha H. Collier of Boston, Mass., had brought out a series of excellent revolvers, revolving rifles and revolving shotguns in London shortly after having obtained a patent for them in 1818, but his venture proved a failure, and only two or three hundred appear to have been made. It has been suggested that the fact that they were fitted with flintlock ignition, already becoming obsolete, may have contributed to their lack of popularity; but there is a certain significance to be found in the fact that he never attempted to revive their manufacture during the subsequent thirty years in which he remained in England, although conversion to percussion lock entailed no radical alteration in their construction.

A study of the records of the British Patent Office reveals little or nothing in the way of revolver patents between 1800 and 1850. Apart from Collier's and Colt's, the only items are three patents for hand-rotated "turret" pistols or guns (of which one is obviously the American "Cochran") and one for a spring-driven revolving gun which, despite the ingenuity of its design, certainly never was produced on a commercial basis. Judging by this scanty display, it would appear that even the amateur inventors—from whom the average patent office derives much of its revenue—were making little effort in this direction during the period in question. The possibility that they were hampered, after 1835, by the existence of Colt's patent is a point that is sometimes suggested—the fact that the bulk of the English revolvers did not appear until after its expiration in 1850 being offered as evidence of the theory. On the other hand, it must be admitted that apart from the intricacies of legal protection, it is difficult to see what particular clause of the patent could have caused such definite hindrance. Taking everything into consideration, the lack of both public and official encouragement was, no doubt, the main drawback.

Colt's first models of the 1836-1842 era appear to have been little known in England. It is on record that during those early days of his manufacturing career he actually entered into negotiations with a certain Richard Pullen for establishing a factory in that country.[1] These negotiations failed, however, and it is quite certain that his early models were not marketed outside the country of their origin. On the other hand, there is little doubt that the reputation gained through their successful use in the Mexican War reached the ears of the British gun trade and reawakened their interest, for at the close of the 1840's, they were importing in small quantities the new models which Colt had started to manufacture at Hartford in 1848. It is possible, too, that some of the Birmingham wholesale firms which manufactured the bulk of the already commonly used "pepper-box" pistols may have started to turn out the earlier models of the crude "transition revolver,"[2] as it is called by present-day collectors, at about the same time. In addition, other members of the trade were beginning experiments on their own account.

IN 1851, Colt arrived in England with a selection of his arms for display in the United States section of the Great Exhibition which had been opened in the new "Crystal Palace" in Hyde Park, London. The extraordinary amount of attention which they drew from the general public and the press certainly would seem to indicate that the revolver was something of a novelty in England those days—though one cannot refrain from wondering how much of the attention was due to Colt's unfailing knack of obtaining the maximum amount of publicity on all occasions. He found, however, that the British gun trade had already entered the field and that three makes—the Lang, the Barnett[3] and

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1. The reference notes are published in full at the end of the article.

the Deane-Adams—were also on view at the Exhibition. Space does not permit of a full description of the first two makes and, in any case, both their popularity and their historical value were secondary to that of the Deane-Adams (Fig. 1, No. 1)—the first model of the famous series with which this article is concerned.

Its inventor, Robert Adams—a partner in the firm of Deane, Adams & Deane, of 30 King William Street, near London Bridge—had patented it earlier in the year,[4] but the Exhibition, as far as one can tell, marked its first public appearance. Though there is very little doubt that Colt's more forceful methods of publicity—coupled with the well-deserved reputation which his arms already had gained—brought him the lion's share of attention, it is safe to assume that the new British revolver also attracted the notice of the more experienced members of the general public. From the technical point of view it was an extremely interesting arm, displaying not only a complete breakaway from more or less traditional details of construction but also some minor refinements which had not been employed by any previous maker.

The most obvious innovation was the system on which the framework of the revolver was constructed—both the body and the barrel being forged in one unit out of a solid blank of metal, with a shallow "strap" passing over the top of the cylinder. It is, perhaps, hardly accurate to call this solid-frame system of construction an innovation, for Colt himself had experimented with it a year or two previously and even had had a few models constructed, though he never actually issued them on the general market. His two patents of 1850 [5] covered a variety of hinged and takedown designs with a strap passing over the cylinder, but in each, the body of the revolver and the barrel were made in separate units. Adams was the first to employ the one-piece forging method of construction, and his revolvers were definitely the first to be produced on a commercial basis with a cylinder spindle which was detachable and which did not act as an integral part of the frame. Octagonal barrels were fitted without exception to the entire range of his models, the earlier specimens being rifled with five grooves which were, incidentally, much shallower than those of the contemporary Colt.

The cylinder was fitted with horizontal nipples screwed into semicircular recesses which had been milled out of its periphery at the rear end. It was a very effective method of nipple mounting for, while it left them fully exposed for their whole length (a useful feature in the event of a jammed cap) it also provided ample insulation against lateral flash. Considerable ingenuity was displayed in the design of the cylinder mounting. Powder fouling on the spindle was always a difficult problem with early revolvers and was a fruitful cause of jammed cylinders and broken lifters. Colt himself, it will be recalled, had experienced this difficulty and had endeavored to counteract it by means of a close spiral groove cut in the spindle's surface.

In the case of the Deane-Adams, the problem was very much lessened by the fact that its system of construction rendered the use of a heavy spindle unnecessary, since the latter did not form an integral part of the frame as in the Colt—its sole function being that of supporting the cylinder itself. It consisted simply of a light steel rod, with a flat knob at the forward end, which passed through the forward edge of the frame and fitted into a recess drilled in the breech, being retained in position by a flat spring catch. Its diameter, as fitted to the largest model of the range produced, was only one-fourth of an inch, and since the cylinder itself rotated on two narrow collars of hardened steel which fitted into the front and rear end of its bore, the friction area was reduced to a minimum.

The lock mechanism was of simple construction. It operated on the self-cocking system; that is to say, the drawing back of the trigger alone rotated the cylinder and raised and released the hammer.[6] There was nothing novel in the basic principle of this system. It is said to have been invented some thirty years previously and had come into common use with the "pepper-box" pistol in the middle 1830's—but the Adams lock was a great improvement on those which had preceded it. The hammer, which had neither a thumb piece nor a half-cock notch, was operated by a V-type mainspring. The trigger unit, which was of more massive design than those of the single-action revolvers, was fitted with a strong hinged sear which was held in engagement with the single notch on the hammer breast by means of a light spring. It carried, in addition, both the lifter and the cylinder stop, the latter being a small square stud projecting backward from the axis.

The action of drawing back the trigger rotated the cylinder [7] and at the same time caused the cylinder stop to be projected through an aperture in the rear end of the bottom of the frame, where it engaged with a recess cut in the side of one of the nipple partitions of the cylinder, locking the latter rigidly in alignment against the opposing thrust of the lifter. Simultaneously the hammer started to rise to the full-cock position, with the cam action of the curve of the hammer breast gradually forcing the sear out of engagement with the notch. At the end of its backward travel the hammer was, in this way, suddenly freed from engagement with the sear and was driven forward again by the mainspring to strike the cap.

This action was undoubtedly one of the best features of the Deane-Adams revolver, for it was not only extremely smooth in operation but of strong and simple construction. It is obvious that from the beginning Adams had done his best to solve the problem inherent in the self-cocking lock—that of reducing the trigger pressure to a reasonable limit. Collars of hardened steel were fitted at strategic points on the lock to minimize friction as had been done in the cylinder. The fitting of as light a hammer as possible, together with the use of special light percussion caps, enabled him to cut down the strength of the mainspring considerably without entailing undue risks of misfires. One peculiarity of his lock mechanism was that each pull of the trigger caused the cylinder to rotate through one-fifth of a circle, which meant that the number of the chambers had to be limited to five. This latter feature is to be found, without exception, in all but the last of the entire range of his muzzle-loading models.

THE first Deane-Adams model was not fitted with a rammer; a new system of loading, to which Adams appears to have attached some importance, was employed. The chambers of the cylinder were bored out sufficiently to enable the ball to slip down easily, the rear end of the barrel's bore being expanded slightly to coincide with this. The mold supplied with the revolver cast both an ordinary spherical ball and a conoidal bullet, each with a small spike or tang of lead protruding from the center of the base. A stout washer (usually of greased felt) was fitted on the latter, being of sufficient diameter to grip the walls of the chamber

firmly. The ball or bullet could thus be pressed by finger into the chamber, the washer retaining it in position against any tendency for it to be shaken out in carrying. Adams also designed and patented a special type of cartridge [8] with which the process of loading could be carried on more rapidly. In this, the charge of powder was contained in a small cylinder of thin copper which was swaged to the tang on the bullet's base, the retaining washer being sandwiched in between the two. The rear end of this cartridge's cylinder was open, but was covered by a disc of thin paper which held the powder in place and was further shielded by a shallow lid of copper, which was detached and thrown away at the moment of loading. It was intended that all the three component parts of the cartridge should leave the muzzle in one unit, but in practice there was a distinct propensity for them to part company, leaving the copper case which had become expanded by the explosion jammed in the chamber.

FIG. 1. PERCUSSION-LOCK REVOLVERS

No. 1. Deane-Adams: original model, 1851; caliber .50; 7¼-inch barrel. No. 2. Deane-Adams: improved model, *circa* 1853; caliber .50; 7⅝-inch barrel. No. 3. Tranter: first model, 1853; separate rammer; caliber .50; 7¼-inch barrel. No. 4. Deane-Adams: self-cocking model converted to double-action; Brazier-type rammer; caliber .50; 8-inch barrel. (All from the J. N. George Collection.)

This type of cartridge appears to have been abandoned when a change was made in the style of bullet used with the Adams' range, its place being taken by others made of paper or "goldbeater's skin" of more usual design. In the process of loading, the hammer was withdrawn from the nipples and set at safety by drawing the trigger back slightly and pressing home a small bar which was mounted on a flat spring on the rear left-hand side of the frame and which acted as an interceptor between the hammer and the nipples. A notch was cut in the rear surface of the bar into which a projection underneath the nose of the hammer fitted. In this way the interceptor was locked firmly in position but was instantly withdrawn by the action of the spring on which it was mounted when the hammer rose at the moment of discharge.

The Deane-Adams was produced in three calibers: .50-, .44-, and .32-inch, with barrel lengths of 7½, 6, and 4½ inches respectively. The caliber .32 model appears to have been issued in proportionally smaller quantities than the other two. It is difficult to assess the total quantity manufactured, but it must have been very considerable, judging by the large number that have survived to the present day. An interesting point is that Deane, Adams & Deane did not actually manufacture the entire output. They had, it is true, a factory of their own in Weston Street on the other side of the river, but a certain amount of its space must have been used for the manufacture of shotguns, possibly of rifles as well, and they did not attempt to build up a large plant entirely devoted to revolvers. A considerable number actually were made at Weston Street, the rest being intrusted to two or three of the big gunmaking concerns in the Birmingham district.[9] It is hard to say why they adopted this procedure instead of launching out on their own account—more especially since Colt had already demonstrated the advantages accruing to the production of revolvers from raw material to finished arm by one concern—but it may be that they had no means of raising sufficient capital for such an undertaking. At the same time, the gun trade in Birmingham was already well established on a large scale, admirably situated from the point of view both of access to raw materials and of distribution of finished products and was quite capable of undertaking manufacture on sufficiently favorable terms.

Another point worthy of note is that throughout the entire Adams muzzle-loading range, the component parts of individual specimens were not absolutely interchangeable as in the case of the Colt, though actually these variations were extremely small. Measurements of the bore of the chambers and barrels were, of course, rigidly standardized and there was a fixed scale of dimensions for the frame, etc., though a certain amount of tolerance was allowed in the latter. Barrel lengths, for example, ranged from 7½ to 8 inches in the large and from 5¾ to 6¼ inches in the medium-sized models. The explanation of this lies in the fact that, although all the major processes in the manufacture of the Adams revolvers were carried out by machinery, a considerable amount of hand finishing also was involved, for the tradition of individual craftmanship was still strong in the British gun trade, and Colt's system of gaged mass production was regarded with some suspicion. Whatever may have been the economic disadvantages of the system under which they were made, it must be admitted that it produced a smoothly working arm whose finish was noticeably finer than that of the Colt.

FROM the beginning, Adams had a formidable rival in the person of Colt, who had undoubtedly set his mind on an invasion of the British and European markets. The first clash between them took place in September 1851 when a comparative trial of the two makes was held at Woolwich, in which the British arm appears to have made rather the better performance. It was not an entirely official affair, and although Adams published a pamphlet on the results, they were not officially confirmed by the Board of Ordnance. A certain amount of mystery surrounds subsequent trials which took place; there were even veiled hints that on one occasion the Deane-Adams under test was deliberately underloaded in one chamber and the barrel burst due to the following charge being fired through it on top of the bullet which had consequently lodged half way down.[10]

From the very first, however, the Deane-Adams had as-

sumed the position of the leading British make—a position which it was destined to maintain in the face of many rivals which came on the market in the two or three years following the Great Exhibition. Nor was its fame entirely confined to England. Considerable quantities were shipped to India, Australia, and the Cape, and in addition, it speedily attracted the attention of certain Continental gunmakers. One or two Belgian manufacturers entered into negotiations with Deane, Adams & Deane and obtained licenses for manufacturing it in their own country at a comparatively early date after its first appearance.

At the same time it would be untrue to assert that the original model was a perfect arm. Its main defect—one which was inherent to all revolvers fitted with the self-cocking lock—was that of disturbance of aim through the relatively long travel of the trigger against the force of the mainspring. As already has been stated, Adams had done his best from the beginning to lighten the action as far as possible, and somewhere about 1853-1854, a slightly modified model (Fig. 1, No. 2) was issued. In this case, as will be seen from the illustration, a more sharply sloped butt was fitted, in combination with a larger trigger which gave a certain increase in leverage.

Another minor addition was the provision of a small sliding safety bolt on the right-hand side of the rear end of the frame. This latched into the locking recess in any one of the nipple partitions, holding the cylinder so that another partition was in line with the nose of the hammer. With the cylinder so secured, it was impossible for the hammer to reach the cap, even if the interceptor bar—which still was fitted—was automatically withdrawn by an accidental pull on the trigger. The first issue of the improved model had no rammer and was designed to use the original wadded bullet. The latter was certainly ingenious, but it is obvious that its performance did not come up to Adams' expectations, for he abandoned it shortly after this in favor of Tranter's new patent lubricated bullet, to which reference will be made later. This bullet could be loaded into the chamber only by means of a rammer, a device which was in the future fitted on all the Adams muzzle-loading models. The first employed (Fig. 2, No. 5) was of the simple bar variety which when not in use clipped into position along the lower left-hand side of the frame. Another type (Fig. 1, No. 4), which embodies a lever and sliding plunger is encountered occasionally.[11]

The British Government had shown what might be called a semiofficial interest in the revolver from the beginning of the 1850's but, unlike the U. S. Government, had made no immediate move toward adopting it officially. On the other hand, it rapidly was ousting the single- or double-barreled pistol as an officer's side arm and, as such, the Kaffir War of 1850-1852 generally is regarded as being the first campaign of the British Army in which the revolver played any part. A sprinkling of Colts—possibly a few English "transition revolvers" also—were carried by officers of the regiments concerned in this war but, up to the present, the author has been unable to trace any reference to the use of the Deane-Adams, though some may have gone out with the later drafts. The advent of the Crimean War (1854-1855) saw the revolver definitely established in the favor of the commissioned ranks of the Army and Navy, with a fairly wide selection of makes available, though the Colt and the Deane-Adams were undoubtedly the most popular. An interesting account of the latter's performance under active-service conditions is to be found in a letter written to Robert Adams by an officer who had taken part in the campaign.[12] This reads as follows:

> Sir: In these days of warfare, any invention of improvements in firearms should be patronized and assisted, and with that view I write you this letter. I had one of your largest-sized revolver pistols at the bloody battle of Inkermann, and by some chance got surrounded by Russians. I then found the advantages of your pistol over that of Colonel Colt's, for had I to cock before each shot I should have lost my life; but with yours, having only to pull the trigger, I was able to shoot four Russians, and thereby save my life. I should not have had time to cock, as they were too close to me, being only a few yards from me; so close that I was bayoneted through the thigh immediately after shooting the fourth man. I hope this may be of service to you, as I certainly owe my life to your invention of the revolver pistol.
>
> I have the honor to be, Your obedient servant,
>
> J. G. CROSSE (88th Regt.)

In a sense, this letter may be regarded as typical of the controversy regarding the relative merits of the Deane-Adams and the Colt which had begun a year or two previously and which continued to rage well into the 1860's, with a series of firearms experts and enthusiastic amateurs expressing their views in a spirit of virulent partisanship which makes curious reading nowadays. Unfortunately one has to admit that much of the professional criticism was inspired mainly by jealousy of Colt's success, for the British firearms trade was inclined to resent the intrusion of his London factory (opened in 1853), and his forceful methods of salesmanship were a source of irritation to them.

Deane, Adams & Deane also produced a certain quantity of revolving rifles. In the main details of design these were very similar to their revolver, the only noticeable difference being the addition of a detachable shield over the hammer, which was fitted to protect the user's eyes in the event of a cap splitting. The barrel was not fitted with a wooden fore-end and it was intended that the rifle should be steadied by the user's left hand grasping the forward edge of the trigger guard, which was specially shaped for the purpose. This foreshortened grip served to keep the left arm and hand out of the way of the flash from the cylinder-barrel joint. Two styles of mechanism were fitted, the first, and most common, being of the same self-cocking design as in the revolver. In the case of the second, which is encountered more rarely, the trigger had to be pulled twice for each shot. The first pull rotated the cylinder and set the hammer to full cock; the trigger was then released to the full extent of its forward travel and on being pulled back once more, released the hammer. In certain details of its construction this mechanism bears a resemblance to the later Beaumont lock. It does not appear to have been patented, but it was definitely in existence in 1853.[13]

OTHER designers were grappling with the problem of curing the disturbance of aim in self-cocking revolvers. In 1853, William Tranter, who was a kinsman of Robert Adams and one of the contractors who manufactured the Deane-Adams revolver, took out a patent[14] for an ingenious modified lock which he applied to the latter arm. Its most outstanding feature was the provision of two triggers, one being of the "spur" variety, passing through a slot cut in the trigger guard. In firing, this "spur" trigger was first drawn and held back by the middle finger, this action serving to rotate the cylinder and raise the hammer, which was then released by a light pressure on the other trigger. Rapid fire could be obtained by drawing both back simultaneously. Actually, Tranter's original design embodied two

triggers, one in front of the other, within the same guard; the "spur" trigger design had been included in the patent as an alternative and was adopted, no doubt, on account of the increased leverage which it gave.

A minor improvement is to be found in the modified safety interceptor bar with which his revolvers were fitted. In general form it followed closely that of the Deane-Adams, but differed from the former in that it was set and released automatically by the action of the cylinder lifter. In addition, he abandoned the Adams wadded bullet, with its accompanying system of barrel and cylinder boring, and employed instead a self-lubricating bullet of his own design [15] of conoidal structure and encircled with a deep groove which was packed with grease. Various types of rammers were fitted as time went by, the earliest of these being a detachable bar, fitted with a plunger, which pivoted on a small peg on the left-hand side of the frame. In spite of its somewhat unorthodox appearance (Fig. 1, No. 3) the Tranter revolver was amazingly popular; in fact it ranked second only to the Deane-Adams in that respect. It was manufactured in considerable quantities—in the same range of calibers and sizes as the latter arm, with the addition of a caliber .36 model—and was still being produced in the early 1860's, despite the fact that an entirely new and improved pattern had been put on the market between 1857 and 1858.

FIG. 2. PERCUSSION-LOCK REVOLVERS

No. 5. Deane-Adams: first double-action model, 1855; caliber .50; 7½-inch barrel. No. 6. Adams: made by the London Armoury Company, *circa* 1857; Kerr-type rammer; caliber .50; 6¾-inch barrel. No. 7. Adams: last muzzle-loading model, *circa* 1864; caliber .44; 6-inch barrel. (Nos. 5 and 6 from the J. N. George Collection; No. 7 from the R. D. Scurfield Collection.)

The next and most important stage in the development of Adams' revolver was the adoption of the so-called "double-action" lock, which combined the features of the self-cocking and single-action types. Adams' partner, John Deane, states in his "Manual of Firearms" (1858) that Mangeot of Brussels, had devised such a lock in 1854 and had started to apply it to the Adams revolvers which were being manufactured in Liége at that time. Early in 1855, the new Mangeot-Comblain revolver with a double-action lock came on the market and rapidly attracted a considerable amount of attention. It is obvious that Adams had been keeping a close watch on these developments, for he took the precaution of obtaining another patent [16] at the end of 1854 which shows evidence that he was contemplating a similar change-over. Actually, the details of this patent contain no special feature beyond the addition of a thumb piece to the hammer and a thumbscrew fastening for the spindle in place of the former simple spring catch. It also covers the design of the safety bolt, which already had been applied to the improved self-cocking model. No reference is made to the lock mechanism, but it is possible that he already had made up his mind to adopt one which had been designed by Capt. F. B. E. Beaumont, of the Royal Engineers, which was patented in the month of February of the following year.[17]

Beaumont's design had the merit of being an actual development of Adams' original and simple self-cocking lock with most of the component parts of the latter retained in its structure—a fact which undoubtedly contributed largely to its adoption. Its most noticeable feature was the provision of a small second sear which was pivoted in the hammer recess in the rear of the frame just in front of the hammer itself. When the revolver was cocked by hand, this sear engaged with the single notch in the hammer breast and held the hammer back at full cock. Simultaneously the trigger was drawn back by means of a small hook in the toe of the hammer which engaged with a long slot cut in the main sear, the latter being held just in engagement with the under part of the second sear itself. Only a slight pressure on the trigger was necessary to free the latter from contact with the notch, thus releasing the hammer. Or, alternatively, the revolver could be discharged rapidly by pulling back the trigger, in which case the main sear came into immediate engagement with the notch, thrusting the hammer backward to full cock and being itself, at the same time, gradually forced forward out of this engagement by the cam action of the hammer breast. At the precise moment that it disengaged itself from the notch it came into contact with the second sear, pressing the latter out of the way and thus enabling the hammer to fall unobstructed.[18]

ACCORDING to Deane,[19] the first English model of the double-action Adams (Fig. 2, No. 5) was put on the market in 1856, but the text of his writing is somewhat confused, and he may have made an error in the date. Taking into account the fact that Adams had already patented its outlines in 1854 and that Beaumont's patent was granted early in the next year, it seems safe to assume that it was on sale by the middle of 1855. Apart from the addition of a thumb piece to the hammer, it differed very little in external details of design from the self-cocking model which had preceded it. The rifling was altered to three grooves, in place of the previous five, with the lands only half the width of the grooves themselves. As far as one can tell, it was manufactured in the same three calibers as hitherto, though strangely enough, the author never has actually encountered a specimen of caliber .32. This, however, is probably mere coincidence.

Though by no means an uncommon model from the collector's point of view, it certainly is found less frequently than the others of the Adams muzzle-loading range. This obviously is due to the fact that it was in production for only about a year and a half and was quickly succeeded by

a new and somewhat improved pattern. Incidentally, a considerable amount of work was undertaken in the same period in converting specimens of the old self-cocking model to double action, the main features of Beaumont's lock design rendering this a comparatively easy task. These conversions can be identified quite readily—the presence of a hammer with a thumb piece in conjunction with a butt of the earlier type on the same specimen being the most obvious sign. Many of them are fitted with the Brazier rammer and all of them show a slight difference in the shaping of the forward edge of the hammer as compared with that on the newly issued model. A typical example is included in the illustration (Fig. 1, No. 4).

The next was by far the most popular of all the Adams muzzle-loading revolvers (Fig. 2, No. 6). It was produced in very large quantities and rapidly acquired a world-wide reputation which was even greater than that enjoyed by its predecessors. Most of its output was in calibers .44 and .32 of the same dimensions as the first double-action model. Experience had proved that the medium size (caliber .44) was quite sufficiently powerful for heavy service conditions and though a certain number of the big caliber .50 model were made, they represented only a small proportion of the total output. The Beaumont mechanism was retained, and the general outlines of the design were much the same, though one or two minor modifications were included. The most noticeable of these was an improved type of rammer which had been designed by John Kerr,[20] a London gunsmith, to whom reference will be made later. As will be seen from Fig. 2, No. 6, its handle consisted of a narrow steel bar, curved at its rear end and pivoted to the lower left-hand side of the frame. This passed through a slot in a cylindrical plunger which moved in a shallow groove cut in the side of a short lug under the rear end of the barrel and which served to drive the bullets home. It was a simple but very effective device, giving considerable leverage which enabled the process of loading to be undertaken without undue effort on the part of the operator. The already familiar safety bolt on the right-hand side of the frame was retained, but the old spring-mounted interceptor bar was abolished and its place taken by a half-cock notch on the hammer breast, which constituted a somewhat obvious improvement.

The London Armoury Company was founded in the latter part of 1856 as successors to the gunsmith firm of John Kerr & Company. In contemporary advertisements they refer to themselves as being "sole manufacturers of the Adams Patent Revolver," [21] but it seems unlikely that their factory in Henry Street, near the south end of London Bridge, could have coped entirely with the very large demand. Birmingham, and perhaps Belgian, contractors were no doubt called upon to fill up the gap. The system of manufacturing remained the same as hitherto; that is to say, the arms were all made to a fixed standard, but the component parts of individual specimens were not actually interchangeable. The very high grade of finish which had characterized the earlier models was fully maintained. At first, the firm's activities were confined to the Adams revolver, but within the space of two or three years they had enlarged their manufacturing scope and were producing, in addition, a special light rifle and a new type of side-hammer revolver,[22] both the invention of John Kerr himself. They also did a considerable business in supplying the official Enfield rifle to the Volunteers of the 1860's.

Adams remained with them as manager for about two years and then, toward the end of 1858, resigned his position and opened a shop of his own at 76 King William Street. The London Armoury Company continued to manufacture the bulk of his revolvers, but his shop was henceforward the main depot for their issue. It also retailed all the various items of the gunsmith's trade, for Adams had not confined his interest entirely to revolvers. He had experimented with the design of a breech-loading rifle as early as 1851 and had incorporated it in his patent of that year; a breech-loading shotgun of his manufacture was awarded the Prize Medal at the Exhibition of 1862. It would be quite incorrect to assume that he was enjoying at this time (1858) anything like a monopoly of the British revolver market. The past five years had seen the advent of a number of rival makes, many of the more recent of these being fitted with double-action mechanisms of various types bearing a certain resemblance in general design to his own arm.[23] The latter's reputation was, however, so thoroughly established by this time that it easily maintained the leading position.

In 1855, the British War Department, following no doubt the recommendations of the Select Committee on Small Arms of 1854, began to purchase revolvers for official issue. The Committee had given the Adams—presumably the old self-cocking model—their approval, but there is no record of their having purchased anything but the double-action models, beginning with the first model of 1855 (Fig. 2, No. 5). Actually they did not decide definitely on the Adams alone, for they also purchased a quantity of Colt's "Navy" model. According to a work of reference published in 1860,[24] the latter amounted to 40,000 pieces, though this may be an exaggeration. As a matter of fact, these purchases did not mark a complete change-over to the revolver throughout the British forces. The heavy single-shot rifled cavalry pistol still was being turned out by the Small Arms Factory at Enfield as late as 1859 and does not appear to have gone out of official issue until the early 1870's. It is interesting to note that the "Textbook for Officers at Schools of Musketry" (1871) refers to it as being "issued to Lancer Regiments, Staff Sergeants, Troop Sergeant Majors and Trumpeters of all Cavalry Regiments."

The Navy was the first to adopt the revolver entirely—a naval drill book of 1859 gives instructions for the handling of both the Adams and the Colt—but in the Army it was retained for issue only to commissioned ranks and for special-service purposes. By about 1860 the War Department's choice had apparently narrowed down to the Adams, for contemporary advertisements refer to it as being "exclusively adopted" and "now solely authorized to be used" by them. It would appear, therefore, that large-scale official purchases of the Colt came to an end at the same period, though actually there are in existence "Navy" Colts of the 1860 pattern which bear the Enfield stamp. These latter are invariably fitted with octagonal barrels; the author has never seen or heard of a specimen of the contemporary round-barreled variety bearing a British Government mark.

The old East India Company—rulers of India in those days—definitely abandoned the single-shot pistol used in their cavalry regiments in favor of the double-action Adams revolver, shortly after the latter's appearance. Considerable quantities are said to have been purchased by various Continental governments and at least one of them—the Dutch

Government—adopted it as their official side arm. A certain proportion of these Continental purchases was filled by the Belgian manufacturers who had specialized in producing (under license) the old self-cocking model, and who were continuing the good work with the new model. They followed the English design closely in all the main details of construction, but there were sundry variations in the shape of the butt and in small details of finish according to the tastes of the various countries which they supplied.[25]

The Adams' reputation had even reached to the other side of the Atlantic. The revolver was no novelty to the members of the American gun trade who visited the Great Exhibition of 1851, but they were undoubtedly impressed by the new English model's solid construction and rapid lock action. Absence of any records makes it impossible to assess the number that were shipped over to the United States, but there is very little doubt that quite soon after its appearance on the English market it became a regular item of the larger American retail gunsmiths' stock in trade—especially in the Southern States where there was a considerable vogue for English arms. Adams took the precaution of covering his design with an American patent in 1853 [26]; both Beaumont and Kerr were to follow his example,[27] with their lock action and rammer respectively, at a later date. It is very unlikely that he ever had any intention of deliberately invading the American market, even when his new double-action model came into being. Such a venture would, in any case, have had little chance of success, for the Colt had already won—thanks to its inventor's energy and to the virtual monopoly which the 7-year extension of the original patent had given him—an unassailable place in that country's favor.

Any chance of securing the interest of the United States Government would appear to have been out of the question, for they had definitely adopted the Colt as their official arm years ago. Yet the interesting fact remains that they did actually purchase a certain number of Adams revolvers, not only during the general scarcity of arms at the outset of the Civil War, but also some two or three years previous. Evidence of this is to be found in an advertisement issued by the London Armoury Company in 1858, in which the words "supplied to the U. S. Government" are to be found. How many were purchased and whether they were officially issued at the time remains a mystery. Can any reader throw light on the subject?

THE Federal Government, in point of fact, could have availed itself during the war of a supply of American-made models from the Massachusetts Arms Company, of Chicopee Falls, which had started to manufacture them during the first two or three years of the 1860 decade. Major Pollard also mentions the Ames Arms Company, of Chicopee, as being manufacturers of the Adams,[28] but as far as one can tell, most of the output came from the former concern. Two models—army and pocket—were produced, corresponding closely in details of dimension and design to the British original. An interesting point is that the larger of the two usually appears to have been made in caliber .36, as against caliber .44 in the corresponding British model. Were any of these American-made Adams revolvers ever produced in caliber .44? The Colt concern had issued a new light .44 model to take the place of the clumsy "Dragoon" as early as 1858, though it is usually referred to as the "Model 1860." Several other American makers had started to turn out revolvers of the same caliber when the Colt patent expired in 1857. In view of this, it seems hard to believe that the Massachusetts Arms Company restricted itself entirely to a maximum caliber of .36-inch.

There is no record in any existing work of reference of the Federal Government actually having made official purchases of the American model, but they certainly imported a large number of English Adams revolvers during the opening stages of the war. The Confederate Government purchased what were, in all probability, proportionally larger quantities, being mainly dependent on outside sources of arms supply. In an article published in an American periodical some thirty years ago,[29] it is stated that "Stonewall" Jackson himself carried an Adams revolver as a side arm, as did many other Confederate officers. A firm of gunsmiths in Liverpool are said to have received a contract for providing a supply of these arms to the famous commerce raider ALABAMA. These are the only references to the use of the Adams in the Civil War that the author has been able to trace so far, though there are no doubt others buried here and there in the vast accumulation of literature which deals with that period of American history.

Production of the 1857 model continued in full force until about 1864 when the Adams Patent Small Arms Company was formed under the management of John Adams. The latter, Robert Adams' brother, had seen service with the London Armoury Company and had done a considerable amount of experimental work, most of the patents in connection with the Adams revolver from 1857 onward being taken out in his name. There is little doubt that in the opening years of the 1860's Robert Adams was beginning to find that the marketing of his new breech-loading shotgun [30] required most of his time and attention. The revolver side of the business was so thoroughly established by then that he was able to leave it in his brother's hands and concentrate his energies on the promotion of the sales of his new sporting arm. The inception of the new company marked another important change in the Adams revolver's history—the introduction of a breech-loading system. In all probability, manufacture of the preceding model came to an end at the same time, but strangely enough, a new percussion-lock model also was produced by them.

This (Fig. 2, No. 7) differed in several respects from its predecessors. The old system of forging the barrel and frame together out of one solid blank was abandoned, the barrel and top strap being in this case constructed in a separate unit which was keyed into the other part of the frame and held in position by cross screws.[31] This design had been patented by John Adams as early as 1857, but there is no record of it having been used until about seven years later. A compound-lever rammer, somewhat similar to that of the Colt, with a round handle which lay along the under side of the barrel, took the place of the former Kerr pattern. The cylinder spindle was held in position by a curve in the rammer handle and could be withdrawn only by freeing the latter from its retaining catch and pulling it down—a device which had been adopted in the United States some years previously in the case of the Remington muzzle-loading revolver. A modified version of the Beaumont lock mechanism was employed, somewhat similar to that which Tranter had fitted to his new double-action model of 1857.

In the original Beaumont design, the second sear had been located in the upper part of the frame and had, in operation,

been forced out of engagement with the hammer notch by the rise of the main sear. In the new lock it took the form of a very small secondary trigger which projected through the frame behind the main trigger, being pressed back by the latter at the end of its travel. Another interesting point is that it was the only model of the Adams muzzle-loading series to be fitted with a 6-chambered cylinder. The simple form of cylinder stop which had been fitted to all the preceding models was retained and the problem of enabling it to engage in turn with six nipple partitions, in place of the former five, was solved by shaping the latter so that instead of radiating straight from the center of the cylinder, as hitherto, they were curved somewhat like the blades of a turbine.

VERY little is known about this last percussion-lock model and the fact that it is definitely the rarest of the early Adams revolvers would seem to indicate that it was produced only in comparatively small quantities, probably during the first year or two of the new firm's existence. The latter's activities were, of course, mainly concentrated on the new breech-loading revolver—a 6-chambered, rod-ejector model which used center-fire cartridges of the iron-based "Boxer" pattern. Its advent may be said to have marked the end of the period of the Adams' history with which this article deals, but the percussion system did, in fact, linger on for some time in the form of a duplex model in which either a muzzle-loading or breech-loading cylinder could be used at will.[32] This type of revolver was designed primarily for the use of the traveler or dweller in the more outlying parts of the Empire, who could not depend on a regular supply of cartridges—the distribution of metallic ammunition throughout the world being by no means thoroughly organized at that period. A patent for an arm of this kind was granted to John Adams in 1861,[33] but his new company appears to have employed the percussion lock only in the case of the model described in the preceding paragraph, and it is doubtful if they ever issued any duplex model. On the other hand, a certain quantity was definitely produced by the London Armoury Company under Adams' patent, being apparently manufactured and retailed by them independently. These were equipped with both a muzzle-loading and a breech-loading cylinder and were fitted with a rammer of the Kerr pattern on the left-hand side of the barrel, a rod ejector on the right. It is also interesting to note that up to the middle of the 1870's, a very large number of the old muzzle-loading models were converted into breechloaders, both by the Adams company and by private firms of gunsmiths.

By the close of the 1860 decade the manufacture of metallic ammunition had become so developed that the necessity for supplying an alternative muzzle-loading cylinder no longer existed. The Adams had become entirely a breech-loading revolver, whose future history does not come within the scope of this article, and the old percussion-lock models which had made its name famous throughout the world had passed into obsolescence.

REFERENCES: 1. Jack Rohan, "Yankee Arms Maker": 1935, 97. 2. A simple conversion of the "pepper-box" pistol, the manufacture of which was confined mainly to England. See "Illustrated Bulletin of the Rudolf J. Nunnemacher Collection of Projectile Arms" (Milwaukee Public Museum): Part II, Plate 88, Nos. 1–5; also Maj. H. B. C. Pollard, "A History of Firearms": 1926, 148, Nos. 8, 11. 3. The Barnett was of the "transition-revolver" type. The Lang was an open frame, single-action arm with a sliding-cylinder gas-check device, similar to that used by Collier in 1818.

4. No. 13,527; February 24, 1851. 5. U. S. Patents Nos. 7613 and 7629; September 3 and 10, 1850, respectively. 6. Lenormand, a gunsmith of Paris, is credited with having produced, in 1820, a fulminate-lock revolver which was fitted with a lock mechanism of this type.

7. This was usually from left to right, as in the case of the Colt, but specimens occasionally are encountered in which the rotation is in the reverse direction. This feature, incidentally, is found only in the self-cocking models. 8. No. 1; October 1, 1852. 9. Notably Tranter, of Birmingham, and Brazier, of Wolverhampton. The firm of Lewis & Tomes of London and Birmingham, also is mentioned in this connection (R. E. Gardner, "Arms Fabricators Ancient and Modern").

10. P. E. Dove, "The Revolver, Its Description, Management and Use": Edinburgh, 1857, 33. 11. Designed by J. Brazier, of Wolverhampton (Patent No. 760; April 5, 1855). 12. Llewellyn Jewitt, "Rifles and Volunteer Rifle Corps": 1860, 62. 13. The J. N. George Collection (Chislehurst, England) includes a Deane-Adams rifle, fitted with this type of lock, which bears a name plate with the date 1853.

14. No. 212; January 28, 1853. 15. No. 2921; December 16, 1853. 16. No. 2645; December 15, 1854. 17. No. 374; February 20, 1855. 18. The description is that of a Beaumont lock which was fitted to a later Adams revolver. His original model had no half-cock notch; otherwise it was absolutely similar in details of design. 19. John Deane, "A Manual of Firearms": 1858, 215.

20. No. 1722; July 28, 1855. 21. The Adams revolvers which originated from their factory were stamped with the letters "L.A.C.," usually on the right-hand side of the barrel lug. 22. The Kerr revolver, which was made in both single and double-action form. A considerable number were purchased by the Confederate Government. 23. They often are incorrectly ascribed to Adams in museum or sales catalogs. Genuine Adams revolvers were stamped with the words "Adams Patent" on the right-hand side of the frame, below the cylinder. Following the trade custom of the period, the name engraved on the top strap was that of the retailer who actually sold the revolver.

24. Llewellyn Jewitt, "Rifles and Volunteer Rifle Corps." 25. Nunnemacher Collection, Part II, Plate 88, No. 15; also C. W. Sawyer, "Firearms in American History": 1910, Vol. II, Plate 5, No. 43. 26. U. S. Patent No. 9694; May 3, 1853. 27. U. S. Patents Nos. 15,032, 17,044; June 3, 1856 and April 14, 1857, respectively. 28. "History of Firearms": 139. 29. John Paul Bocock, "Pistols with Pedigrees": *Outing*, February 1903.

30. Patent No. 285; February 3, 1860. 31. No. 2824; November 7, 1857. 32. A parallel is to be found in the case of muzzle-loading Colts converted to breechloaders on the Theur system (U. S. Patent No. 82,258; September 15, 1868). 33. No. 1758; July 12, 1861.

Editor's Note: For similar authoritative and complete description of another historic weapon by the same author, readers are referred to "The Pepper-Box Pistol" (Army Ordnance September-October, 1936, Vol. XVII, No. 98, p. 90).

Emergency Construction

Procurement Planning for the Building Industry

By W. R. Winslow*

THE important part played by construction in modern warfare hardly needs to be emphasized to readers of ARMY ORDNANCE. Our basic national-defense policy specifies only a minimum standing army to assure adequate research and development in military equipment and technique in peace and to serve as an emergency protective force and trained nucleus for expansion in war. Hence this policy necessarily must contemplate construction for the processing, training, and shelter of the large force to be inducted into the military services in time of war. Similarly, our policy of maintaining minimum war reserves and of limiting Government arsenals and factories to little more than the capacity needed to maintain the peace-time establishment, makes construction of production facilities for military matériel also essential.

The cost in the World War of the construction by the Army alone was $800,000,000. Effort is being made in present planning to reduce this cost in any future war by prescribing maximum use of existing structures for training and shelter and by survey and allocation of existing manufacturing facilities with a view to making increased use of suitable civilian production agencies in lieu of new construction. An important group of war production facilities, however, such as loading and explosives plants, finds no counterpart in civil life, and only a very limited number of existing structures are suitable for shelter and training purposes. The construction load therefore will still be very large, and the importance of adequate planning is in no way diminished. The entire project for enlistment and training of personnel still will be dependent in large measure upon adequate and timely construction of cantonments and many of the key items in the supply program will be produced by facilities constructed after declaration of war.

Important as this element is in war planning, it has been perhaps the most neglected. It is only within the last three years that the basic operation—determination of war construction requirements—was completed. Since that time, however, progress has been gratifying. Once the inertia caused by the magnitude of the task and certain ambiguities in regulations as to responsibility were overcome, all planning agencies involved have coöperated until today the war construction plans can take their place alongside the other plans for military operation and for the mobilization of industry.

THIS is the sixth of a series of articles on procurement planning by chiefs of the various divisions of the Planning Branch, Office of the Assistant Secretary of War. It describes the studies and policies anticipated for the coördination of the building construction industry to meet the needs of the defense services of the United States in time of war.

The war-time load on the construction industry, judged by experience, demands peace-time analysis in order that haphazard policies may be avoided in an emergency. Not only are economy of effort and the prevention of waste desirable objectives, but more pressing are the availability and prompt utilization of the industry in order that time may be saved. The steps considered for the maximum utilization of this effort, on a factual and fair basis, by the war-time mobilization agencies are discussed in this analysis.

Previous articles in this series were: "The Army and Navy Munitions Board," by Col. H. W. T. Eglin (March-April 1937 issue, p. 275); "Standards for Army Supplies," by Capt. George V. McPike (May-June, p. 344); "Procurement Planning," by Lieut. Col. G. M. Barnes (July-August, p. 21), "The Allocation System," by Maj. Scott B. Ritchie (September-October, p. 77) and "War-Time Contracts," by Maj. C. C. Fenn (November-December, p. 154). Other articles in the series will follow.—EDITOR.

The National Defense Act (Sec. 9) states: "The Quartermaster General, under the authority of the Secretary of War, shall be charged with: . . . . the direction of all work pertaining to the construction . . . . of buildings, structures and utilities other than fortifications connected with the Army. . . ." This basic provision is defined and elaborated by various orders and regulations. There follows an outline of the existing War Department policy with regard to war construction:

1. Operation. All construction of fortifications and that in the theater of operations will be conducted by the Corps of Engineers. All constructions (not in the theater of operations) necessary to the mobilization of his command is a responsibility of the corps area commander. All other construction by the Army is charged to the Quartermaster General.

2. Procurement of Construction Materials. Building materials for fortifications and for construction in the theater of operations will be procured by the Corps of Engineers. Materials for all other construction by the Army will be procured by the Quartermaster General (except local procurement to meet emergencies which is permitted corps area commanders).

3. Supervision. Preparation of basic plans and policies and supervision of activities for construction for procurement are charged to the Assistant Secretary of War. For all construction other than for procurement, these duties will be exercised by the General Staff. Procurement of all construction materials by the Army will be supervised by the Assistant Secretary of War.

4. Industrial Mobilization. Responsibility for the adequate mobilization of, and negotiation with, industrial organiza-

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tions essential to war construction is a function of the Assistant Secretary of War.

5. For planning purposes construction projects are considered under three heads: (a) *Command construction,* or that directly connected with mobilization or strategic plans such as cantonments, corps area supply points, mobilization camps, ports of embarkation, storage depots, etc.; (b) *Supply arms and service construction,* incident to production or procurement of military matériel, such as at manufacturing depots, arsenals, loading plants, etc.; and (c) *Construction by an industrial facility,* incident to production of military supplies.

THE duties of the Construction Division, Office of the Assistant Secretary of War are derived from the above policies. They are: (1) Promulgation of basic rules and policies in regard to construction for procurement; (2) Assurance that requirements of construction for procurement are accurately known and that adequate plans are made for performing this construction; (3) Assurance that requirements for *all* types of construction are sufficiently studied to permit proper analysis of industrial and procurement factors entering therein; (4) Determination of the coördination and control necessary to insure mobilization of the construction industry and adequate and orderly flow of building materials; (5) Preparation of the plan for assuring the above; (6) Determination of rules and policies for negotiation with the construction industry and for procurement of building materials; (7) Preparation of the plan for the necessary supervision of these activities.

The first constructive step toward obtaining concrete figures of war construction requirements was made in January 1935, when all corps area commanders and chiefs of supply arms and services were required to submit a statement of location, purpose, general description, and certain additional data for every construction project needed in war under the Mobilization Plan of 1933. Compliance was approximately complete by September 1935.

Preliminary studies dealing with requirements of building materials, supervision of the construction industry, and contractual relations for war construction were begun with the requirements obtained as above. By the use of the data obtained, the Quartermaster General was able to make out a complete list of type structures for mobilization. A full-time staff of officers and draftsmen was placed on the work of preparing type plans and specifications for all mobilization structures. A complete list of these structures was prepared and submitted to corps area commanders, commanding officers of exempted stations, and all other agencies requiring mobilization type construction. These were to indicate the structures of each type required to meet the mobilization plan. Completion of these data was accomplished in the fall of 1936. They furnish a detailed and very complete list of requirements for all mobilization construction. The General Staff recently has determined that changes must be made in the Mobilization Plan of 1933, and a new plan now is being written. This will require revision of requirements and calculations for construction, but the basic studies with regard to mobilization of, and contact with, the construction industry of the nation will be little altered.

Projects for procurement construction then were checked against the records of the Allocation Division, Office of the Assistant Secretary of War, to be sure that a report had been made of each and forwarded back to the procuring services and to the Quartermaster General. It was explained that approved projects are to be filed; that they form the basis for the war plan of the Office of the Assistant Secretary of War for mobilization of the construction industry; and that clearance will be required for projects not included in the approved program.

DATA for type A projects have been submitted to the General Staff for check against the mobilization requirements. When approved, the same procedure will be followed as for projects for procurement construction. Projects will be filed in the Office of the Assistant Secretary of War as an integral part of the plan for mobilization of the construction industry and for the use of Commodity Committee No. 8 (Building Materials) and forwarded to the Office of the Quartermaster General for inclusion in the plan for construction and preparation of type plans and specifications.

It should be noted that, while assurance that corps area construction plans (discussed later) are adequate is the direct responsibility of the General Staff, it is nevertheless important that the Office of the Assistant Secretary have accurate, up-to-date information on requirements of this type of construction.

This latter office is charged with the plan for the necessary mobilization of, and negotiation with, the construction industry, with the plan for building materials production and distribution and, in time of war, with presenting and defending the Army construction program before the war superagencies. It is essential, therefore, that complete requirements data for corps area construction be maintained in the Construction Division, Office of the Assistant Secretary of War.

Upon final determination of needs it was possible to begin the plans of the operating agencies for procurement of the required construction. Such plans fall logically under two headings: construction for procurement, and command construction.

As noted above, construction for procurement includes two types, B and C. Type B construction falls under the responsibility of the Quartermaster General. The war plan for performing this construction will be prepared by that office. It is included in the War Construction Plan, Office of the Quartermaster General, and is discussed later. Type C construction is that by an industrial facility in connection with the production of military supplies. The degree of control over this type of construction to be exercised by the Government will depend upon the type of contract negotiated. This is discussed later in treating negotiation with industry. Planning for this type of construction is the direct responsibility of the procuring arm or service. Where a factory plan has been accomplished, plans for the necessary construction will be included therein.

In cases where factory plans are impractical or unnecessary, it is the responsibility of the procuring branch that the required construction be accurately determined and that the industrial facility understand the type of contract used and method of reimbursement for construction. Every effort will be made to obtain maximum coöperation from industry in bringing plans for type C construction to a maximum state of completeness.

Planning for this type of construction has progressed slowly due largely to the fact that the work must be done by the civilian facility concerned. Such plans are expensive and the Government has no authority to require expenditure of funds for this purpose. Progress is being made however. The fact that production facilities are informed of construction required, their responsibility thereto, and the type of contract to be negotiated, is a distinct step forward.

THE major construction load is that of the Quartermaster General. His office will: (1) Make all Army construction other than fortifications and that directly connected with mobilization of corps area commands; (2) Procure building material for all construction by the Army other than that required for the theater of operations and certain emergency purchases of corps area commanders; (3) Procure all real estate.

Plans for the Quartermaster construction problem, involving as they must extensive drawings and specifications and large expansion of personnel for administration, disbursement, procurement, and inspection, until recently have not progressed beyond general provisions for decentralization; *i.e.*, expansion of the offices of the present Six Zone Construction Quartermasters and an increase of zones to nine to correspond in general with corps areas. The Quartermaster General in 1935, however, placed an officer and staff of assistants on full-time duty in preparation of the Quartermaster construction plan and definite progress is being made. At this writing, the office is engaged in preparation of type plans and specifications for mobilization structures. Plans have been made for operation of war-time construction in all corps areas. The majority of these plans involve expansion of the office of the corps area Quartermaster as the construction agency.

Construction in the theater of operations will be performed by the Corps of Engineers. Such construction will be made by troop labor and will not affect the plans for mobilization of the construction industry. The program for procurement of building materials and for the mobilization of that industry will, however, be affected directly. Requirements of materials for this construction have therefore been included in the plans for Commodity Committee No. 8 (Building Materials), discussed later.

With this brief review of the method of operation, the plan for mobilization of the construction industry may be examined.

A study has been made by the Construction Division, Office of the Assistant Secretary of War, of the construction industry of the country. The problem imposed by war was examined from the standpoint of construction proper and of the supply of principal building materials. It was found that: 1. The construction industry is the second largest in the country and has large numbers of employees. 2. Resources and production capacity for building materials are ample for war. 3. Total construction during a year of war will involve a substantial reduction from the average volume of construction of the last ten years and will be less than the volume of construction for any one year, except the depression years 1932 and 1933. 4. In certain limited industrial areas construction is congested to a point exceeding the capacity of all available construction facilities and is such as to tax transportation and handling facilities for building materials to a point of breakdown. Control policy is therefore considered under two headings: the United States as a whole (for which general coördination measures only will be necessary), and the critically congested districts (where direct-control methods will be required).

GENERAL coördination will consist in publicity and contributory measures. The Public Relations Administration will be advised of measures directed toward keeping the construction industry informed of the war program; stimulation of coöperation by the industry; and encouraging rapid completion or stoppage of nonessential work in progress and the inhibiting of nonwar projects. It is, of course, important that nonessential construction be curtailed. This will be to a degree automatic as a result of the price, wage, and business uncertainties necessarily accompanying war.

Studies prepared from data now available indicate that the industrial areas surrounding four of the large cities of the country will be critically congested with regard to construction. Since transportation and handling facilities for the major building materials are incapable of marked immediate expansion, stocks of these materials must be strictly controlled in congested districts. Construction facilities are relatively mobile, but since efforts to relieve shortage in critical districts by use of nonlocal facilities would tend merely to extend the area of congestion and also to add to confusion and competition between war agencies, strict control over facilities in critical districts also will be maintained. War Department agencies will be required to obtain clearance from the Construction Division before initiating any projects in these areas.

Control will consist of: (1) Survey of construction facilities to determine availability, adequacy, and fitness to handle war work; (2) Strong inhibitory measures toward nonessential construction. Building materials will be refused, by action of Commodity Committee No. 8, to builders refusing to coöperate; (3) Designation of contractor for specific projects; (4) Release to military construction agencies of lists of eligible bidders for specific war construction projects; (5) Direct requisition on the Contributory Division for release of sufficient transportation; (6) Immediate request to the Selective Service Commission for deferment of requisite building craftsmen in these districts; (7) Close contact with Commodity Committee No. 8 for requisition of stocks of construction materials on hand.

THE necessary information with regard to the construction industry and contact therewith will be effected by means of the War Service Committee (Construction Industry). A war-service committee is a group selected by each branch of industry or trade to serve on its behalf as a point of contact with the Government. Survey of industry and designation of facility for specific projects prior to M-day are deemed impractical for construction because of the highly variable nature of the industry, the relative mobility of facilities, and particularly the fact that suitability of a facility for war work will depend directly upon its occupation at the time of the emergency. In view of the limited number of districts requiring close control, it will be possible to obtain the required data and make the necessary decisions after M-day by the use of a group of experts with access to the information compiled by national organizations of the industry.

In view of the representative nature and authoritative character of the membership, the committee also will be used as a liaison agency to keep industry informed of the Government's requirements and to keep the Government informed of the problems of the industry.

Supervision of the work of the operating branches will be the minimum that will insure compliance with plans and policies established. It will consist in requiring: (1) Notification of any changes or cancellations in construction programs; (2) Notice of contemplated projects over $25,000 not previously included in an approved construction program (It will be essential that the Office of the Assistant Secretary of War be provided at all times with a complete and up-to-date picture of the Army construction program to insure intelligent presentation before the war superagencies.); (3) Notice of all construction contracts let (Similarly, this office must have up-to-date knowledge of the status of construction contracts.); (4) Clearance of construction projects in the specified restricted areas. (This will provide an effective means of imposing the strict controls necessary in these areas.)

Two types of contract have been approved for war construction by the Army: the fixed-price contract, and the evaluated-fee contract. (There is also the evaluated-fee contract for subcontracts.) The first type is similar to the peacetime contract form with the addition of a clause protecting the contractor from rises in prices of materials and labor caused through action of any Federal price-control agency. This clause should eliminate one of the major uncertainties mitigating against lump-sum contract agreements in war and consequently this type of contract may be used in a large number of cases. Where the size of the project or the lack of accurate plans makes definite bidding impossible, or where no reasonable bid is obtainable, the second form of contract (a modified cost-plus agreement) will be used.

IN the published restricted districts, request for clearance will be made by the operating branch (Quartermaster General or corps area commander) to the Construction Division. Clearance will be granted (under advice from the War Service Committee) either without restriction, with list of eligible contractors, or with designation of specific contractor. In the latter case, the contractor will be notified simultaneously by the War Service Committee of his selection to do the particular job. The contracting officer will at once negotiate the evaluated-fee contract notifying the Construction Division when the contract is signed.

In the other two cases, and in all cases not in restricted districts, resort will be had to competition wherever practical. Bidding time will be shortened and circulation restricted to local contractors. In the event that a reasonable bid is not received, the evaluated-fee contract will be negotiated. Those bids received may furnish a sound basis for selection of the contractor for negotiation. When, due to the restricted number of eligible bidders, the incomplete or indefinite state of plans and specifications, or the chaotic state of prices or wages, a fixed-priced agreement is impracticable, the evaluated-fee contract will be used. In cases involving a small number of eligible contractors it will be possible generally to negotiate a contract by direct conference with the eligible contractors. When this is not practical, contractors may be given opportunity to advance reasons for their selection. Those best qualified will be considered as makers of identical bids and in accordance with War Department regulations the contractor for the negotiated contract will be selected by lot.

TYPE C construction will be made by industrial facilities for enlargement or conversion of factories for military production. Two types of contract will be used: fixed-price and adjusted-compensation contracts. The following policies with reference to type C construction will be observed: 1. New construction will be reduced to a minimum in war time. 2. War-time construction will be of a temporary nature. 3. The construction of industrial facilities in war will be controlled to insure the prompt supply of materials when required. 4. The fixed-price supply contract generally will include in the contract price the amortization of additional facilities. The contractor will provide for the necessary expansion or conversion of facilities at his expense. If terminated by the Government, the contract provides for an equitable adjustment of the unamortized portion of the cost of such facilities, provided the contractor submits with his bid a list of new facilities required for the performance of the contract. 5. The adjusted-compensation contract provides that the Government will reimburse the contractor for necessary additional buildings, machinery, equipment, and facilities devoted to the contract. Such property will become the property of the Government when the contractor has been reimbursed therefor. 6. The producer will contract for the construction of additional facilities. Where a substantial expansion of plant facilities is required, the arrangements contemplated should have prior approval of the Assistant Secretary of War. 7. Circular proposals for the manufacture of supplies in time of war should contain the following provisions:

"It is understood that the bidder has adequate present facilities for the manufacture and delivery of this material within the time promised if awarded contract.

"If additional facilities or equipment are necessary, or the bidder will require a priority certificate or aid in securing equipment, the facts will be stated in proposals."

In the restricted districts, clearance will be required exactly as for types A or B construction. Clearance will be requested by the procuring branch. In remaining areas, the producer will be left free to select his own construction agency, report being made to the Construction Division when contract is let. Negotiation of contract will be between the producer and the construction facility.

With the fixed-price contracts for production, no inspection of construction is required other than general notation of the work performed. In cases where amortization of construction has been the subject of negotiation in determination of the price of the finished item, inspection must be such as to satisfy the Government that the construction agreed upon is actually performed. Responsibility for this rests with the procuring branch.

Where production is obtained under an adjusted-compensation form of contract, the contractor will be reimbursed for the cost of the necessary construction. Inspection must include complete cost accounting and timekeeping on the construction project. This inspection will be conducted by the procuring branch as an integral part of its production contract, although any necessary technical assistance required in connection with the undertaking will be obtained from the Construction Section, Office of the Quartermaster General.

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Month by Month

AS announced in the last issue of ARMY ORDNANCE, Mr. Alvan Tracy Simonds, president of the Simonds Saw & Steel Company, recently accepted appointment as Assistant District Chief of the Boston Ordnance District. We welcome him as a leader in the industrial life of America to the high responsibility which our Ordnance district personnel share in our scheme of national defense. He and his fellows throughout the country, who have an official status in ordnance preparedness, constitute a group whose service to the nation, although little known in times of peace, will be of untold value if an emergency ever should come to us.

ALVAN T. SIMONDS, ASSISTANT CHIEF AT BOSTON

Mr. Simonds, a native of Fitchburg, Mass., was graduated from Phillips-Exeter Academy in 1895 and from Harvard University, where he specialized in economics and metallurgy, in 1899. At Harvard he was a student of Professor Sauveur, the well-known scientist and member of the Metallurgical Department at Harvard. Following his graduation Mr. Simonds attended the School of Metallurgy at Sheffield, England.

Upon the completion of his studies he entered the employ of the Simonds Saw & Steel Company in 1900 as a laboratory assistant and in turn became department foreman, cost accountant, advertising director, purchasing agent, vice-president and president of that company. Simonds Saw & Steel Company was established in 1832 by Mr. Simonds' grandfather. Its principal factory is at Fitchburg with branches at Chicago and Montreal and a steel mill at Lockport, N. Y. The company normally has about 2000 employees; it is the country's second largest saw producer and the largest machine knife manufacturing organization.

Early in the World War Mr. Simonds was commissioned a captain in the Ordnance Department, serving in Washington from May to December 1917 in charge of the purchase and production of helmets and body armor. In addition to his industrial activities, Mr. Simonds has been a constant student of the theory of economics and the fundamental principles underlying business relationships. His philosophy is that of the greatest good for the greatest number. He is an exponent of private enterprise without governmental action except such as may be necessary in the protection of life, personal and property rights of individuals, education and public health. He has devoted a great deal of his effort to spreading a knowledge of economics and to the discussion of questions affecting the national welfare. He established the open forum in the city of Fitchburg and for many years offered two prizes of $1000 and $500 for the two best articles on an economic subject. He has published many articles in the various magazines and trade journals as well as a book on business fundamentals. He is a member of the visiting committee of the Graduate School of Business Administration of Harvard University, a director of the Union Twist Drill Company and of the Worcester County Trust Company. In 1931 Boston University conferred upon him the honorary degree of doctor of commercial science.

Ordnance preparedness is fortunate in having the interest of Mr. Simonds. His willingness to serve is characteristic not only of his own public-spiritedness but of the same willingness of other leaders in industry throughout the United States. Under the direction of Col. Charles H. Tenney, Chief of the Boston Ordnance District, that important manufacturing area is in the forefront of Ordnance plans for war-time procurement. Colonel Tenney also has gathered about him an advisory board. We hope soon to present in these pages biographical sketches of the board members.

Meantime, on behalf of his confreres throughout the country, ARMY ORDNANCE extends to the new Assistant District Chief a hearty welcome in the firm expectation that one who has rendered such service to the peace-time industry of the nation is of untold value to its war-time responsibilities. Mr. Simonds has proved himself in both capacities already, but his formal service in the Boston District makes certain that the administrative reputation for which it long has been famous is increased by the service of one whose record is characteristic of American industry.

THERE recently has been instituted, particularly in the Ordnance procurement districts, a new term of Reserve officer training which reduces the period from fourteen days to six. The purpose of this reduction is to make limited training funds go further. By restricting the trainees to officers within the immediate locality of the district headquarters, travel funds also are saved. The scheme is already in operation in some districts.

SHORT-RATION TRAINING

This seems to be a worthwhile experiment, and it is to be hoped that Ordnance Reserve officers will take kindly to it. Money considerations aside, many of the Reservists are frequently unable to devote two weeks to the active-duty training period. When they do, it sometimes means they forego an annual vacation from business. This new scheme has the advantage of not imposing too greatly on one's time, although the period hardly is long enough for most desirable results.

However it is a condition which has to be faced. Technical officers are not trained as frequently as tactical officers. This, of course, is a mistake and is a reflection that antiquated ideas of man power still prevail in high places where it should not be necessary to emphasize the growing importance of munitions power. As long as training funds are allotted on the basis of eighty per cent to tactical training and twenty per cent (or less) to technical training, the policy is shortsighted, to say the least. Under the circumstances the only thing to do is to train alone and like it. Good soldiers never complain about short rations even though they regret the absurdity of conditions which shortened them.

The State of the Army

THE annual report of the Secretary of War for the fiscal year 1937 discloses some noteworthy advancements in the state of the Army and it also indicates many vital objectives yet to be achieved. On the credit side can be entered the modest additions in personnel, modern improvements in all types of equipment, advances in training methods, and a rise in morale and efficiency of the three components of our military defense: the Regular Army, the National Guard and the Organized Reserves. On June 30, 1937, the strength of the Regular Army was 12,269 officers and 158,626 enlisted men. The number of enlisted men increased by about 12,000 during the year. The number of commissioned officers increased by about 200—the Army being still far short of its proper complement. As Secretary Woodring states, "It must be remembered that our officers are needed not only for our troop units, but also to serve as instructors for the civilian components of the Army, for staff and overhead duty at War Department and field headquarters, as faculty and students at service schools, and a wide variety of nonmilitary duties such as river and harbor improvements, the maintenance and operation of the Panama Canal and other similar activities."

Air Corps expansion and the use of larger and more complicated types of aircraft have made necessary an increase in the number of officers assigned to this arm. To meet deficiencies of officer personnel the Secretary recommends that the commissioned strength of the Regular Army be fixed at approximately 14,500 to be reached by annual increments of 500 during the course of the next four or five years. Morale has been increased by better housing. Mr. Woodring urges that consideration be given to a revision upward of pay schedules particularly for enlisted men and junior officers. He calls attention to the fact that the base pay of enlisted men of the Army is $21 a month while that of the young men enrolled in the Civilian Conservation Corps is $30 a month. By comparison with enlisted men in the Navy, whose base pay is also $21, this rate pertains only to recruits of less than three months' service whereas seamen who have completed training receive a minimum of $36 per month. The restoration of reënlistment allowance for career soldiers is also urgently recommended.

Also on the credit side is the marked progress which has been made in modernizing the equipment of our Army. The modernization program contemplates over a period of years practically the complete reëquipment of our troops with the latest types of transportation, means of communication and weapons. As of June 30, 1937, the Army had on hand approximately 1000 new military airplanes, nearly all of them less than three years old, another thousand were being manufactured and several hundred serviceable planes were on hand classified as obsolete. These obsolete ships will be replaced within the next year or two. The ultimate goal in airplane strength is 2320 modern serviceable planes to be in operation not later than June 30, 1940. This number of planes is the goal recommended as highly desirable by the Baker Board three years ago. Developments in tanks, modification of field guns and motor vehicles are also to be placed on the credit side. But procurement in quantity of many of these important items, due to insufficiency of funds in most cases, is not at all what it should be.

Rearmament with the newer types of equipment, despite notable production of the light tank, must still be entered on the debit side of the record. We quote Secretary Woodring:

"In the procurement of other types of equipment we have not been progressing as rapidly as desirable. We lack sufficient antiaircraft artillery to provide properly for the defense of vital areas. I hope that sufficient funds may be made available to permit the orderly procurement of sufficient modern equipment for all antiaircraft regiments of the Regular Army and National Guard and for a sizeable reserve for emergency use. A good start has been made toward modernizing our seacoast defenses, but much more is needed in armament and other equipment to provide for the effective defense of our vital harbors.

"Substantial progress has been made in the modification of field guns and carriages to provide for high-speed towage and for greater flexibility of fire. The Army has large amounts of horse-drawn artillery which may be towed by motor vehicles when properly equipped. By other modifications the field of fire can be greatly increased. . . .

"The procurement of semiautomatic shoulder rifles and of light and heavy machine guns is a continuing program of the War Department. However, it will probably be several years before sufficient numbers are procured to meet the needs of our organizations and to provide a reasonable war reserve. Hence, this procurement also should be accelerated."

As to matériel, the Secretary recommends the continuation of the present policy of aircraft procurement so that a strength of 2320 modern serviceable planes be attained by 1940. He further urges that "the program of modernizing the equipment of all components of the Army should be accelerated in order that we may quickly improve and expand such organizations as the Air Corps, the antiaircraft artillery, and seacoast defenses. New and improved weapons, transportation, and means of communication should be procured at increased rates in order that the orderly rearmament and reëquipment of our combat units may proceed as rapidly as budgetary limitations will permit."

Mr. Woodring's recommendations demand the active support of the entire country. From our viewpoint what he recommends toward the acceleration of reëquipment is all too true and it is to be hoped that in this day when national expenditures must be reduced if we are to remain solvent, expenditures for national defense be not reduced until our military house is in order. This is sanity only, and the American people seem to be soundly in favor of keeping their heads—at least when it comes to providing for the common defense.

Exit the Big Battalions

An Editorial

NOT since Clausewitz wrote about the order of battle in his famous work, "On War," has a more momentous thing taken place than the principal effect of the proposed infantry division for our Army. The principal effect we take to be the man power reduction in war strength of the division from some 22,000 to some 13,000 men without reduction of fire power. Many other effects there will be from the new organization, but in these figures alone lies a significant advance which proves the rising influence of machines and the lessening influence of masses of men on the battlefield.

Here, it may be, is a prelude to the decline of the "big battalions" and a return to smaller formations. Here also is the beginning of increased demand upon armament and supply and a departure from men to machines. This trend from men to machines lessens the burden on the human individual and transfers it to the mechanical unit, thus demonstrating the increased importance of weapons in the strategy and tactics of defense. It will be most unfortunate if this full meaning of the achievement is not realized or appreciated by all students of preparedness.

THERE are some basic principles of military organization for larger tactical units worthy of recollection. A generation ago discussion was rife as to the relative merits of the "square" or the "triangle" as a tactical formation. The "triangle" has the advantage of economy of force; the "square" has the advantage of reserve power. Today, economy of effort through mobility and fire power is the predominating view, and it is well displayed in the new division. An economy of more than 8000 men without reduction of effective battle strength would have been unthinkable only a quarter of a century ago. Yet see how the trend today is to even greater economy of flesh and blood.

Maj. Gen. Fox Conner, commanding general of the First Corps Area, was an official War Department observer during the preliminary tests of the new organization at Fort Sam Houston and Leon Springs Military Reservation, Tex., last fall. General Conner believes that the divisional development is definitely on the right track. But it is still too large. "I believe," said General Conner, "the division should have a force of no more than 10,000 officers and men when organized at war strength and that when . . . . the War Department begins its comparative study it will decide on a permanent division of 10,000 men."

Well may we say the "big battalions" are on the way out. They are on the way out to the quickened tempo that 22,000 bears to 10,000. And thank God for it. The burden is transferred from the backs of men to the wheels and shafts of machines; armor bears the brunt, and man power is protected and conserved.

In another place in this issue Lieut. Col. Raymond Marsh presents an analysis of the distribution of functions in the new organization particularly as they relate to Ordnance service. These are considerations of the first order of importance. They must be met satisfactorily if the responsibility of weapon supply is not to bog down and produce the immobility which the new organization definitely seeks to prevent. But whatever the final disposition of these important details, the broader meaning of the trend must not be missed, for it goes to the very essence of the philosophy of industrial preparedness.

ACTUALLY, machines in warfare are the problem. Without the machines and the men to supply them—men who reach back to the factory and the mine, who increase in numbers as the tactical unit decreases in size, who provide the things that produce the machines that protect the soldier who wins the battle—without the machines and the ability to make them the streamlined division could not be. In that homely fact lies part of the reason why the big battalions ever came about in the first place.

This new organization thus turns out to be a Chestertonian paradox: it becomes less only to become more, its decrease (in men) becomes an increase (in machines), its ease of mobility (on the battlefield) becomes a strain of mobility (in the factory). And should we not also say its power for the offense is at once its power for the defense? The combat army of tomorrow need not be reckoned in terms of four million men!

But it is in this very paradoxical relationship that the trouble lies, or will lie, if there is not a proper appraisal of its meaning. It would be too much to expect the worthy lunatics who prattle about nationalization of arms production to understand what we mean. But it should not be too much to expect our military, naval, and industrial fellow citizens to grasp it. New forms of military organization which reduce man power place new and greater responsibilities upon munitions power. Only to the degree that we are industrially prepared in time of peace can the new divisions work in time of war. Similarly, the demand increases for more skilled officers and men. Already the War Department is taking steps to increase the officer strength of the Army, principally to meet the needs of the Air Corps—a branch where mechanization is the very heart of the establishment. As quality of the machine improves, quality of its guiding mind also must improve. In other words, while the need for quantity of man power is reduced by the newer forms of defense, the demand for quality of man power is increased by the same causes.

There is no occasion for wonder in all this. Only the unrealistic twaddlers, who think peace can be preserved by talking about it, are asleep. Sensible people have been alive to this change for the past twenty years even though they have not always been alive to its obligations. How else account for the steady trend the new weapons have created in growing measure with each succeeding year? Armament, personnel, and organization have not been dormant anywhere the world over. But in armament the change has been most noteworthy. Rifle power is no longer thought of in terms of the shoulder rifle, for the machine gun forced the character of the World War when there was no such thing as a semiautomatic rifle. The automatic rifle still further increased the volume of infantry fire.

Resistance, once thought to be crushed by weight of artillery fire, soon turned to the tank, for "weight of material

failed even as had weight of man power." No weapon of war during the past generation has escaped the transition, while many of the older forms, such as mortars, grenades, and even camouflage, have been refurbished and put to their traditional uses in new dress. Yes, every weapon, including the oldest of them all and probably the most potent of them all—propaganda—has been seized upon for whatever of value it may bring to strategical success.

IT would be difficult for the layman to translate into actual figures the precise effect of the proposed division on fire power even though the reduction of man power is definitely indicated. Suffice it to say that the new organization achieves at least the same fire power with nearly half as many men. It would not be surprising to learn that fire power is actually increased. Be that as it may, the effect of the new organization on supply is all too apparent. Not only is this true of the weapons themselves; it is doubly true of ammunition. Only recently in a published report from the headquarters of the new division during its autumn test this point was fully stressed in the following words:

"Adequate supply of ammunition is absolutely necessary in the successful prosecution of any military campaign. The constant flow of ammunition to all weapons is required if a battle is to be effectively waged. Guns are useless without projectiles to make them effective as weapons. Moreover, the tide of battle may be changed from success to defeat if ammunition is not brought up promptly to insure the continuous operation of weapons.

"Men can fight, and have been known to do so, without food for several days, but never without ammunition. At the opening of the World War the French had ammunition last on the priority list. But within eighteen months they had recognized the importance of ammunition in waging war and as a result moved ammunition from last to first on the priority list. Some idea of the value of ammunition may be obtained from noting that the cost of ammunition fired in a field artillery gun before it is worn out amounts to 30 times as much as the original cost of the weapon, and the weight of this ammunition is 100 times the weight of the gun.

"Responsibility for supply of ammunition rests on the shoulders of the division Ordnance officer.

"Since the speed with which it can operate as a partially motorized unit has greatly increased the problem of supplying the Army's new 'streamlined' Infantry division with ammunition, the supply of this essential military commodity is undergoing very thorough tests in connection with the maneuvers of the new division. When the tonnage of ammunition consumed by a division in one day is shown, the magnitude of the ammunition supply problem becomes apparent. The normal consumption, called a day of fire, by the division is around 345 tons.

"This figure, broken down, reveals that the Infantry regiments may be called on to fire as many as 22 tons of small-arms ammunition in a day; the machine-gun battalion, 6 tons; the Field Artillery regiment, 5 tons of small ammunition, 96 tons of ammunition for the 75-mm. guns, 63 tons for the 81-mm. mortars; 103 tons for the 155-mm. howitzers—a total of about 260 tons. The reconnaissance squadron will normally use another eight tons, and the engineer battalion two tons, both in small-arms ammunition."

And then there are the vast questions of maintenance. As to the exact allocation of this function well may we leave the task to those military men who performed it so effectively during the World War and to students who have specialized in it. In this respect the Ordnance Department is particularly fortunate. Its maintenance activities during the war were monumental and they were performed in a manner which deserves lasting tribute in the record of American war-time operation. It is to be hoped that experienced judgment will be given full weight when the final allocation of these services and their organizational requirements are determined. Whatever theoretical determination may lead to, practical experience should be a deciding factor in the final adjudication.

HOWEVER this may be, the maintenance function must not be minimized. One has only to consider the servicing of the machines mechanization has introduced to the field of combat to realize that they are part and parcel of modern transportation requirements. This goes as well for the automotive equipment as for the ordnance. For some of us the ease with which we can engage a mechanic's services at a garage or service station may obscure the maintenance problem of a mechanized division on the march. Not only must the automotive equipment be kept in serviceable repair but the guns and carriages and the arms as well as the ammunition must be in working order. In this latter respect a "streamlined" division is no different from its older counterpart: it will not be worth the road space it occupies or the terrain it covers if its weapons are not where they ought to be or if they cannot deliver their accustomed fire. Maintenance of all categories places upon any military organization demands of the highest tactical and mechanical importance.

All these phases of modern military organization, particularly as they apply to the new division, must receive constant study. We hope that the ensuing months in these pages and throughout our current military literature will be characterized by constructive discussion on the part of competent authorities. No finer service toward the development of military science could be rendered. So we leave this to the experts being fully conscious that proper solutions will be arrived at and that pressing problems will be solved. We desire here to emphasize the developments especially from the standpoint of their effects on industrial preparedness.

In the face of these developments and their weighty implications, relatively few people have thought the thing through to determine how the needs of mechanization can be met. Unfortunately too few of our military minds—"the man-power geniuses"—are farsighted enough to question whether weapons always can be supplied in quantity and in time. How many people, military and civilian (but excluding the politicians), realize what this means? As the big battalions of fighting men make their way out from the battlefields, saving half their numbers, the big battalions of industry, multiplied by five, must make their way into the factory. If they do not, or worse, if they cannot, then we would be wise to keep the big battalions. As horrible and senseless and cruel as the price in flesh and blood would be, defeat would be worse. If we only could grasp the simple truth that the big battalions *can* go, victory *can* be assured if our industrial power is ever ready to furnish, in increasing quantity and complexity, the weapons of defense. The "if" grows bigger each day!

Professional Notes

ORDNANCE AT THE NATIONAL MATCHES

BY PHILIP B. SHARPE

The following article describes some of the behind-the-scene duties of the Ordnance Department in connection with the annual National Matches. Great credit is also due the National Board for the Promtion of Rifle Practice and the National Rifle Association under whose auspices the Matches are held. It is to be hoped that liberal funds will be provided for the Matches in 1938 for they are one of the best single investments in preparedness in the entire nation. A well-schooled rifleman is a permanent investment; he is not subject to obsolescence nearly as fast as the weapons with which he trains. The National Matches are a guaranty that American riflemen always will be at hand and we believe the following article will help emphasize the importance of one of the organizations which contributes so effectively to this end.—EDITOR.

FEW persons really appreciate the tremendous volume of work connected with the National Rifle and Pistol Matches held each year at the Ohio State Range at Camp Perry. Their continued growth has reached the point where the work involved becomes the major problem. At the 1937 Matches, for example, nearly 7000 active shooters were on hand to take part in competition and to engage in the firing practice which the Matches offer.

Three weeks of continuous firing demands more than mere ammunition supply. It requires careful planning on the part of executive officers, proper storage of arms and ammunition to prevent delay and congestion, and an efficient organization to operate the ranges both at the firing line and at the pits.

Ordnance at the 1937 National Matches was, as usual, in charge of Lieut. Col. Charles H. Traeger, commanding officer of the Erie Ordnance Depot, with Maj. James L. Hatcher as ordnance technical adviser. Colonel Traeger assigned two non-commissioned officers to handle the bulk of the routine—Staff Sgt. James E. Thompson and Sgt. William H. Harrison. These men were assisted by five enlisted men to handle the detail work, and the Erie Ordnance Depot was drawn upon for trucks and chauffeurs to handle transportation.

Arms and ammunition supplies for the Matches are requisitioned by the executive officer of the National Matches from the Chief of Ordnance and are paid for by the executive officer from National Match funds. Plans for this phase are formulated nearly a year in advance, but the actual work for the National Matches, insofar as the staffs at Camp Perry and Erie are concerned, begins about August 1st with the Matches scheduled for the latter part of that month.

Arms and ammunition are shipped to the Erie Ordnance Depot rather than to Camp Perry. This depot is situated about five miles west of Port Clinton on the shores of Lake Erie and at the present time is practically surrounded by Camp Perry. The growth of the Ohio State Rifle Range makes it necessary to utilize facilities on both sides of the Erie Depot, and the Erie roads are opened to permit traffic to cross the depot to reach the small-bore and pistol ranges.

The small-arms ammunition used at the National Matches is always of a special grade. This National Match ammunition is turned out after extensive tests and development work at Frankford Arsenal. It is shipped through to the Erie Depot in a single carload lot. And speaking of carloads of ammunition, it is interesting to note that very few really appreciate how much ammunition can be transported in the average box car. According to Colonel Traeger, National Match ammunition is boxed in the usual metal-lined wood cases usually painted blue and stenciled in large white letters "NM" signifying match-grade ammunition. Properly packed, between 600 to 700 boxes can be stored in one car, depending, of course, on the size of the car. One carload shipment showed a gross weight in caliber .30 ammunition of 78,670 pounds. This carload consisted of slightly more than 600 boxes of ammunition, totaling about one million rounds. This is the average size of full carload shipments. This ammunition received at Erie is given temporary storage on the reservation prior to the National Matches; none of it is stored at Camp Perry.

RECORDS show that about 1,500,000 rounds of caliber .30 National Match ammunition, including a small quantity of Palma Match, were consumed at the 1937 Matches. In addition, some 400,000 rounds of caliber .45 National Match cartridges were shipped in for various pistol and submachine gun matches, together with more than 50,000 caliber .22 long-rifle cartridges for small-bore matches. There was also, of course, a large quantity of commercial ammunition brought in by various competitors or sold on the grounds by the ammunition manufacturers represented on Commercial Row. Moreover, for the 1937 Matches Springfield Armory was called upon to supply 1900 of the 1937 National Match rifles of which 1050 were new and 850 were previous National Match rifles completely reserviced, rebarreled, and otherwise restored to perfect condition. Three hundred of the new rifles were set aside for sale to members of the National Rifle Association desiring to make the purchase at Camp Perry.

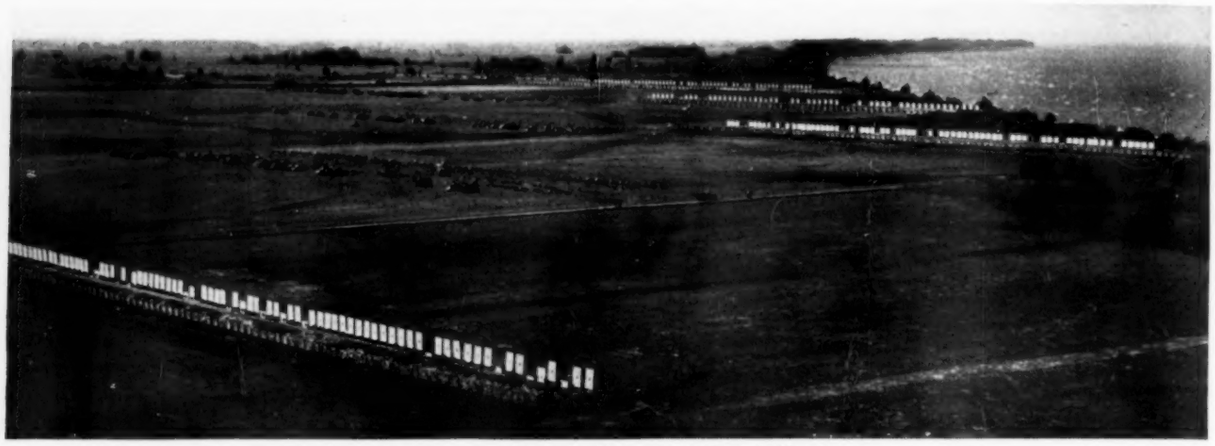
The incoming rifles and pistols create more of a problem than the ammunition. Each gun must be completely stripped and freed of the excess mobilubricant used to protect it against rust. Inspection of each individual piece for possible damage in transportation includes the occasional replacement of minor parts, such as damaged sights. The arms are then ready for issue.

The Ordnance Department Supply Depot at Camp Perry opened a few days previous to the National Matches for early arrivals and was always a busy spot. This building was open twenty-four hours a day so that incoming shooters could draw arms and other equipment immediately upon arrival regardless of the hour—thus preventing unusual congestion at the normal morning opening time.

Repair parts and other units were turned over to the Ordnance repair depot located on Commercial Row under the direction of A. L. Woodworth, senior technician at Springfield Armory. This depot maintained a complete service station for repair and alteration of National Match rifles and pistols throughout the duration of the Matches. When the Matches start, the Ordnance Department must be ready to supply the necessary quantity of rifle and pistol cartridges each morning. Most of the unused ammunition is returned to the Erie Depot each night; only a small quantity is kept on hand at Camp Perry to take care of the customary range shortages which necessitate additional supplies on brief notice.

The Ordnance Department also must arrange to gather up discarded brass, and an efficient system of range regulation enabled this material to be kept cleaned up at all times. None is permitted to lie around the firing point, even during the noon hour when the ranges are not occupied. Used brass is stored in empty cartridge boxes and returned to the Erie Depot to await the end of the Matches whereupon it is barreled and returned to Frankford Arsenal.

THE above routine necessitates much work with limited personnel. The arms and ammunition arrive at the Erie Depot June 1st and the staff is kept busy handling this throughout the following three months until the Matches open. As the Matches close, rifles, pistols and other equipment turned in to



SOME OF THE FIRING RANGES AT CAMP PERRY

the Ordnance Department must be individually inspected, cleaned, and boxed for return to Springfield Armory. Records must be kept of spare parts on hand, spare parts consumed, and damaged parts replaced. At the 1937 Matches, a staff of five men was available at the Ordnance repair shop to service Match guns. This year Springfield Armory seems to have ironed out the majority of "bugs" before the opening of the Matches, so greatly reducing the work thereby that a portion of the crew was sent back to the Armory at the mid-point of the Matches.

The National Matches are becoming more successful each year. The event is actually more than a mere gathering of shooters: it is a proving ground of Ordnance small-arms equipment. Army experts carefully check all developments including the functioning of the official Army rifle and the service automatic pistol. Precision ammunition is manufactured and performance checked in Ordnance Department laboratories. The actual proof of the pudding is in the eating—and Camp Perry eats up ammunition!

Nearly one billion rounds of ammunition have been shot through targets into the waters of Lake Erie. During Camp Perry's long history, shooting precision has advanced and world records have been established only to be broken as improved ammunition and arms have been made available. In addition, the National Matches offer excellent training for riflemen all over the country. The usual Small Arms Firing School preceding the Matches qualifies graduates as instructors, and the continued strength of the United States Government depends upon its ability to mobilize and train an emergency army on short notice. Graduates of Camp Perry form the nucleus of the corps of rifle, pistol, and machine-gun instructors.

The 1937 National Matches—the largest yet—were marked by unusual public interest. Station WLW at Cincinnati broadcast two 15-minute programs over a WLW-NBC national hook-up.

The National Matches for 1937 were an outstanding success, but no one, except those individuals actively engaged in executive and operations work, can appreciate the tremendous amount of labor and detail involved in facilitating the "smooth" shooting of nearly 7000 shooters.

"MINIGUNS"

BY HERBERT E. STIER

WHO has not watched with interest the advent and widespread acceptance of the minature camera? Much of the time and money now being expended on hobbies are devoted to photography and its allied arts. And so, if the camera enthusiasts have their miniature cameras, why cannot the shooters have their miniature guns?

The demand for such petit weapons has been recognized of late by a number of the handgun manufacturers and has brought about the Harrington and Richardson 2-inch barrel, the Colt Woodsman with 4½-inch barrel and many other such developments, mostly in the caliber .22 long-rifle class—one manufacturer having seen fit to make an automatic pistol with a short barrel for the .22 short rim-fire cartridge. Yet with all these developments in this country, we cannot overlook the fact that manufacturers in Europe also have been awake to the trend. This has been particularly true of the Walther factory in Germany which has been manufacturing small, practical handguns for quite a few years.

It is the writer's opinion that no arm is quite so acceptable to casual shooters, "plinkers," or fishermen as a small caliber .22 automatic pistol. This want is, in my experience, well filled by either the caliber .22 Walther PP (police pistol) or the caliber .22 Walther PPK model (short police pistol). This gun possesses portability and compactness together with unusual accuracy for the ranges at which such a weapon would be used.

Many sportsmen have hesitated to adopt an automatic or, more properly, a self-loading pistol, because they have not been able to rely upon it to shoot all kinds and types of ammunition; moreover, many consider the automatic pistol unsafe in inexperienced hands. The Walther pistol, therefore, possessing all the good features of the automatic weapon with its accompanying compactness, plus the reliability and safety of the revolver, is an ideal gun for the sportsman. The weapon is made in three calibers: .22 long-rifle, .32 automatic and .380 automatic—the most practical gun being the .22 and the one which would receive the greatest amount of usage due to the cheapness of the ammunition.

Unfortunately, these German pistols are subject to the high duty imposed on firearms of foreign manufacture. There is no caliber .22 American automatic pistol with an exposed hammer available at this writing, and I have heard many shooters remark that if they only could "see the hammer" they would have confidence in an automatic. A .22 automatic, known as the Reising, which had an exposed hammer was manufactured for a time.

THE literature supplied with the 7.65-mm. Walther pistol lists many features of these weapons: "The new Walther automatic pistol, caliber 7.65-mm. Police Model, combines, due to its locking mechanism designed on absolutely new principles, the great advantages of the self-loading (automatic) pistol with the safety and immediate readiness for firing of the revolver. . . .

"While in secure position (red circle covered by the safety lever), the pistol can be loaded by withdrawing the sleeve over the barrel sufficiently to insert a cartridge into the cartridge chamber before the barrel without the pistol being cocked thereby. In this state the pistol can be carried without the risk

of an accidental discharge and yet is ready for action without the help of the second hand, because the marksman presses up the safety lever into its ready-for-fire position (red circle visible) and pulls the trigger as with a revolver.

"There is provided besides, as on a revolver, a safety position of the hammer which prevents the latter, while at rest, from touching the firing pin. The corresponding locking device sets the hammer free only at the very last moment. The unsecured and ready-for-action pistol may fall on the uncocked hammer, or the latter may be struck from the outside without a shot going blind. (See illustration.)

"When the last cartridge is fired, the pistol remains open and closes only after removal of the empty magazine or insertion of a full one. The removal of the magazine is made even easier now than before, due to a little improvement on same consisting of a hook-shaped extension piece. Another new feature of the Police Model is the signal pin (not present on either the PP or PPK caliber .22 pistols of this model.—AUTHOR) which . . . . is visible at the rear end of the sleeve above the hammer. . . . It protrudes as soon as there is a cartridge in the cartridge chamber."

Following are main features of weight and measurements:

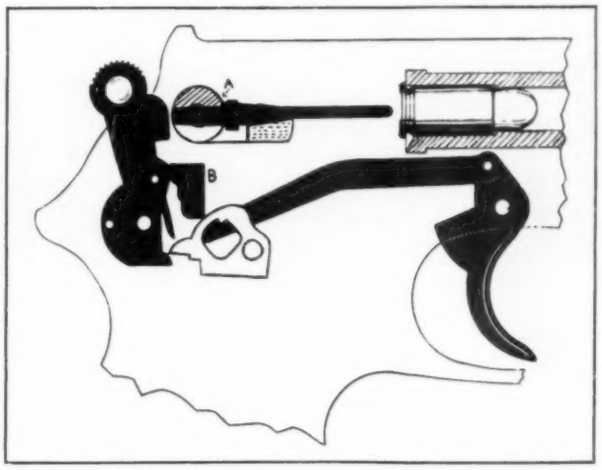
	PP	PPK
Total length	170 mm. ($7\frac{5}{16}$ in.)	$5\frac{7}{8}$ in.
Length of barrel	98 mm. ($3\frac{7}{8}$ ")	$3\frac{1}{4}$ "
Height	109 mm. ($4\frac{1}{4}$ ")	4 "
Thickness	22 mm. ($\frac{7}{8}$ ")	$\frac{7}{8}$ "
Weight (Approx.)	600 gr. (1 lb. 7 oz.)	1 lb. 3 oz.
Caliber	7.65 mm.	
Catridges in magazine	8	

The arm is, therefore, very adaptable to the novice who knows little about the functioning of an automatic weapon and frequently forgets that it is always loaded. There is no doubt that until a person learns all the features of the automatic it is potentially more dangerous than the revolver. Yet it seems that the average shooter always is fascinated by the self-loading pistol.

Along with the frequent use of the term "automatic" pistol in this country it should be borne in mind that such pistols sold and used are, with a few exceptions, not strictly automatic in that they do not empty their cartridge containers with one pull of the trigger. They are more properly self-loading pistols. It is to be noted that in most designs, particular pains are taken to insure that the pistol cannot be altered to fire full automatic; yet it can be done and is done. Witness the patent issued on such a change fully described in ARMY ORDNANCE in the article, "Weapons and the Law" by Ralph Milne Farley (Vol. XVIII, No. 104, September-October 1937). Specimens of the Luger have been altered to fire full automatic, but they have proved very unsatisfactory.

AT the time the Walther .22 pistol was procured by the writer it was planned to obtain both a specimen of the caliber .22 and the .380. I was informed, however, that the domestic sale of the 9-mm. short, or .380, was prohibited in Germany, although it could be exported. The main objective in having the two pistols was not to get practice with the cheap ammunition of the caliber .22 but to compare as closely as possible the interchangeability of the two arms. Perhaps they would not interchange as readily as the 7.65 and the .380 but I do not believe it would require a serious change in production methods to manufacture the 9-mm., a military caliber, from existing stocks of caliber .32 weapons. This is efficient designing, as the more parts that can be interchanged in the various calibers, the cheaper the factory can sell individual weapons.

The use of high-speed ammunition for this pistol in caliber .22 was undertaken with a little uncertainty. However, I tried out two brands of American high-speed ammunition and found that they functioned perfectly; apparently the gun was not damaged in any way. Whether or not it will stand the continual pounding of the high-velocity ammunition is a question I cannot answer at this time, but I have found that the regular-velocity cartridges gave all the satisfaction that was desired; I feel that the barrel is just a little too short to realize fully the value of the high-velocity product. I have tried all brands of domestic ammunition and find that only due to one faulty cartridge has there been any trouble with the gun.



THE WALTHER'S DOUBLE SAFETY

The firing mechanism is in the rest position with the outside safety (*A*) released. In this position the inner safety (*B*) automatically blocks the hammer, preventing it from striking the firing pin. The shot can be fired only after the hammer has been fully cocked.

I just have had the privilege of examining and shooting a specimen of a light-weight model of the caliber .32 PP pistol. It is of the same excellent construction as the other pistols though extremely light in weight. However, I did not find it held steady, and the recoil was not to be ignored. The pistol seems to be made of duralumin with a high tensile strength well able to stand the use of ordinary pistol ammunition. It is hoped that more data will be obtainable on the caliber .32 PP pistol at a later date.

There is still another product of the Walther factory which requires the attention of the shooter who is interested in "miniguns," namely, the caliber .25 Model 9 using the caliber .25 automatic-pistol cartridge. This is the smallest automatic pistol in this caliber that the writer has had the privilege of seeing and using. I have one in my collection and have fired it about fifty times with only one make of ammunition. I have found this little weapon functions perfectly, but even a person with small hands would find it practically impossible to hold it steady enough to obtain reasonable accuracy—at ten feet.

To give the reader some idea of the size of the Model 9, it may be well to compare it with a known model—the Colt .25 Automatic:

	Colt .25	*Walther Model 9*
Length	$4\frac{1}{2}$ in.	$3\frac{1}{16}$ in.
Height	3 "	$2\frac{5}{8}$ "
Thickness	1 "	$\frac{3}{4}$ "
Weight	$13\frac{1}{2}$ oz.	9 oz.
Number of shots	7	7

We have come to many a change in this day and age, and just as the camera has been reduced in size until it has found a special niche in everyday life, so the small pistol and revolver may come to have a special place and use in the shooter's kit. We are thus in a period of evolution in this field; it may be slow, but with constant use of the smaller weapons by those who prefer such easily carried arms, they will achieve the same popularity among shooters that the miniature camera now enjoys among its followers.

Association Affairs

WASHINGTON POST

MAJ. GEN. WILLIAM H. TSCHAPPAT, Chief of Ordnance of the Army, was the honor guest at the first luncheon meeting of the current season held by the Washington Post December 7, 1937. The Post had the good fortune also to include among its other distinguished guests the Assistant Chiefs of Ordnance, Brig. Gens. Herman W. Schull, Chief of Manufacture, and Edward M. Shinkle, Chief of Field Service, and Col. Harry B. Jordan, Ord. Dept., Director of the Army Industrial College.

At this gathering new officers and directors of the Post were elected for the ensuing year. Maj. I. A. Luke, Ord. Dept., well known for his Ordnance service both in the technology of ammunition and as a former instructor of the Ordnance R.O.T.C. Unit at Stanford University, was elected president and presided at the meeting. Major Luke succeeds Col. Earl McFarland who resigned as president some months ago due to his transfer from Washington.

Lieut. Col. Henry P. Erwin, Ord. Res., was reëlected first vice-president and Lieut. Col. Charles Demonet, Ord. Res., was elected second vice-president. Colonel Erwin, following his service in the Ordnance Department during the World War, was one of the founders of the Association and served for a time as a member of its headquarters staff during the organizational period. Colonel Demonet has had a long and distinguished career both in active service and as a Reserve officer of the Ordnance Department. He is a leader in the District of Columbia in Reserve affairs and has established an enviable record in his management of the annual C.M.T.C. enrollments in the Third Corps Area.

Three new directors were elected at the meeting. They are: Col. Fred. H. Wagner of Baltimore, Col. Hardee Chambliss and Maj. S. E. Reimel, both of Washington. Colonel Wagner is esteemed in the Ordnance fraternity not only for his actice service during the war but also for his contributions to industrial preparedness, particularly in the Baltimore Ordnance District. He is a frequent contributor to ARMY ORDNANCE and is acknowledged as a leading American authority on the history and development of tanks. A consulting engineer, Colonel Wagner has developed many processes of commercial application in the chemical and mechanical arts.

Colonel Chambliss is professor of chemical engineering and dean of the Engineering School at the Catholic University of America. He served with distinction in the Ordnance Department where his energy and professional ability were outstanding in the administration of nitrogen fixation. Following the war and prior to his return to civil life, he commanded the nitrate plant at Muscle Shoals, Ala. Major Reimel is executive officer to Brig. Gen. H. W. Schull, Chief of Manufacture of the Ordnance Department. He has held many posts of responsibility in the Department and prior to his present service in Washington was Ordnance officer of the Seventh Corps Area at Omaha, Nebr. Other directors of the Post whose terms of office have not expired are: Hon. Swagar Sherley, Col. George B. McClellan, Col. Fred E. Wright and Lieut. Col. LeRoy Hodges.

The Washington Post proposes to hold a series of luncheon meetings during the winter and spring of 1938. The membership has grown and under the guidance of its new president the Post looks forward to an interesting program of professional and social activities. Its first luncheon meeting on December 7th had a record attendance of nearly 150 members and friends.

PERSONNEL

DURING the past month notice has been received of the following activities of members of the Army Ordnance Association:

Five important changes in the organization of Caterpillar Tractor Company recently were announced by President B. C. Heacock. Mr. C. Parker Holt turns over the office of executive vice-president to Mr. A. T. Brown, formerly vice-president generally administering the accounting, treasury, traffic, and parts departments. Mr. Holt returns to the San Leandro (Calif.) office of the company where, as vice-president, he will direct all Caterpillar activities there and coördinate the work of the several departments with the headquarters of those departments in the Peoria offices.

Two new vice-presidents have been elected: Mr. L. B. Neumiller, formerly director of industrial relations, is now vice-president generally administering the parts, service, and traffic departments, as well as continuing active management of industrial relations. Mr. D. G. Sherwin has been advanced from treasurer to vice-president generally administering the advertising, sales, and treasury departments. Mr. D. A. Robison, formerly assistant treasurer, has been elected treasurer.

Mr. A. P. Buquor, assistant to the president of the Martin-Parry Corporation of York, Pa., recently has become president of the Canadian branch of that company. Mr. Buquor is well known for his development of the adapter by which field artillery of the National Guard of the United States has been modernized for high-speed transportation. His pioneer work in this field has led to other developments of high military value. The Martin-Parry adapter is of prime importance to those defense units, such as the National Guard, where economy of time in training and of operation expense is essential. The 75-mm. high-speed gun carriage developed by Mr. Buquor is a definite advance in the motorization of the field artillery. Maneuvers and practice marches made by various organizations equipped with this matériel have shown that dependable equipment easily adaptable to old design is not only a decided advantage in the economical utilization of gun barrels, the carriages of which have become obsolete, but also in the general achievement of mobility and speed so necessary in the mechanization and modernization of field equipment of the present day.

Harris & Ewing

A. P. BUQUOR

NEW MEMBERS

THE following have been admitted to membership in the Army Ordnance Association: Henry S. Beal, Chicago, Ill.; C. Harold Berry, Cambridge, Mass.; H. Berkey Bishop, Boston, Mass.; P. G. Blackmore, Cleveland, Ohio; S. E. Bramer, Pittsburgh, Pa.; James I. Brennan, Pittsburgh, Pa.; J. R. Bright, Bethlehem, Pa.; Charles H. Buckingham, Batavia, Ill.; Edward W. D. Bunke, New York, N. Y.

J. L. Camisa, Ridgewood, N. J.; D. J. Campbell, Muskegon Heights, Mich.; Charles A. Carlson, Washington, D. C.; DeElton J. Carr, Corning, N. Y.; C. F. Carrier, Bethlehem, Pa.;

Charles E. Cole, Hoboken, N. J.; S. E. Conner, Watertown, Mass.; Carlton J. Cook, Binghamton, N. Y.; D. W. Cooper, Bethlehem, Pa.; Arthur J. Couse, Chicago, Ill.; Walter S. Cox, Camden, N. J.; James H. Crispin, Los Angeles, Calif.; Wallace M. Cutler, Cambridge, Mass.

R. A. Dean, Bethlehem, Pa.; Frank W. Delano, Everett, Mass.; Paul W. Dillon, Sterling, Ill.; Frederic J. DeWitt, Jr., New York, N. Y.; Charles S. Draper, Cambridge, Mass.; V. J. Del Duke, Brookline, Mass.; Enright A. Ellis, Downingtown, Pa.; Albert L. Farrington, Oakland, Calif.; E. A. Fisher, Bethlehem, Pa.; John M. Gallagher, Jr., Palmerton, Pa.; S. E. Giulio, Bethlehem, Pa.; William S. Graham, Pittsburgh, Pa.; W. D. Hemenway, Jr., Clayton, Mo.; Samuel B. Heppenstall, Pittsburgh, Pa.; H. H. Hevenor, New York, N. Y.; William E. Hopkins, Newton, Mass.; Platt S. Horton, Wilmington, Ohio; William Irwin, Bethlehem, Pa.

R. E. Jeffrey, Jr., Martinez, Calif.; Hobart L. Jones, Pompton Lakes, N. J.; Frederick Juer, Bethlehem, Pa.; C. D. Kelly, Chicago, Ill.; R. M. Kelso, Aliquippa, Pa.; Alan Kissock, New York, N. Y.; A. H. Kramer, Dayton, Ohio; Robert M. Kuphal, Minneapolis, Minn.; Brayton S. Lewis, New Britain, Conn.; Wheeler Lord, Philadelphia, Pa.; James E. Lose, Pittsburgh, Pa.; W. Orland Lytle, Pittsburgh, Pa.; Archibald S. MacNeish, Dorchester, Mass.; Donald F. Madigan, Chicago, Ill.; Gayle W. Maile, Columbia, Mo.; D. Q. Marshall, Bethlehem, Pa.; Frank R. Meyer, Jr., River Forest, Ill.; Edward H. Miller, Clayton, Mo.; P. W. Mulder, Almont, Mich.

Francis A. Parker, Auburndale, Mass.; Walter A. Patscheider, Auburndale, Mass.; Alfred J. Porter, Jr., Bridgeport, Conn.; James Prendergast, Claremont, N. H.; E. L. Roth, Milwaukee, Wis.; Donald S. Sampson, Washington, D. C.; Edw. Rotan Sargent, Philadelphia, Pa.; K. J. Schatzlein, Bethlehem, Pa.; Hugh F. Schmidt, Cambridge, Mass.; W. J. Schmidt, Jr., Bethlehem, Pa.; Grant B. Shipley, Pittsburgh, Pa.; Ralph Simes, Dorchester, Mass.; Winford P. Smith, Great Neck, N. Y.; Nelson E. Spurling, Brooklyn, N. Y.; George W. Starr, Canton, Ohio; G. W. J. Stout, Erie, Pa.; Harry M. Sutton, Boston, Mass.; Gustaf Swenson, Watertown, Mass.; C. E. Tuttle, Baltimore, Md.; Karl A. von den Steinen, East Cleveland, Ohio; F. von Schlegell, Jr., Pasadena, Calif.; Francis Waddingham, Inglewood, Calif.; Lawrence L. Wagener, Metuchen, N. J.; J. Eckley Walker, Jr., Baltimore, Md.; W. J. Winter, St. Augustine, Fla.; R. J. Young, Jr., Buffalo, N. Y.; H. A. Zeller, Huntington, W. Va., and J. A. Zupez, St. Louis, Mo.

NECROLOGY

MAJ. ERNEST J. SIEBER, Spec. Res., a charter member of the Pittsburgh Post, Army Ordnance Association, died October 4, 1937. For many years past he had been assistant manager of the Standard Sanitary Manufacturing Company of Pittsburgh. He was appointed a major in the Specialist Reserve July 5, 1929 with assignment to the Pittsburgh Ordnance District as chief of the Machining Section, Manufacturing Service.

Active in the affairs of the district and of the Pittsburgh Post, Major Sieber gave long and faithful service to the ordnance cause. His death is recorded here with special regret for the loss of a patriotic gentleman whose services to the national defense and to industry were of the highest order.

Notice also has been received of the death of the following members of the Association: Robert A. Bull, Chicago, Ill.; D. F. Crawford, Pittsburgh, Pa.; John H. Gewecke, New York, N. Y.; George K. Gilbert, St. Louis, Mo.; F. R. Hickman, Southport, Conn.; John A. Lindstrom, Brooklyn, N. Y., and H. B. Siebe, New York, N. Y. To their relatives and friends, ARMY ORDNANCE, on behalf of the Association membership, extend condolences.

Ordnance Field Service

ORDNANCE SERVICE IN THE CORPS, PART II

BY LIEUT. COL. RAYMOND MARSH, *Ord. Dept., U. S. Army**

THE limited facilities of the corps Ordnance office are utilized to the fullest extent in the preparation of the corps Ordnance plan. The army supply plan and the approved army Ordnance plan must be carefully considered and followed. Consideration and full compliance must be given to the plans for the corps' tactical employment, to the decisions of the corps commander and the G-4 with reference to the general supply policies to be followed in the contemplated operation, and to the tentative plans of the other corps supply services. Like the army Ordnance officer, the corps Ordnance officer must have full knowledge of the composition and Ordnance equipment of his unit (the corps) for the coming activities, the status of Ordnance supplies therein, credits allocated and credits available.

Based on this information, the corps Ordnance plan will include, generally, an estimate of the probable requirements of the corps for the coming operations, the location of the heavy-maintenance company, the location of such refilling points for both ammunition and general supplies that may be established, the time at which these refilling points will open, the credits given to corps troops and subordinate units at these refilling points, the schedules which will be followed by troop units in drawing these supplies, particularly ammunition, the disposition of the ammunition carried by the corps Quartermaster trains, any special instructions needed for the coördination of the several maintenance units in the corps, and information relative to inspections and requirements for personnel for duty as inspectors.

In addition to preparing these plans, the corps Ordnance office has continuing functions very similar to those of the army Ordnance office, such as action on requisitions, consolidation of ammunition expenditure reports, designation of depots from which indicated troop units will draw supplies, etc.

As a corps staff officer, the corps Ordnance officer is privileged to inspect any and all Ordnance activities within the corps to assure himself, for the benefit of the corps commander, that Ordnance service within the corps is satisfactory and to determine, when the Ordnance service is not satisfactory, what corrective measures should be recommended. When it comes to technical inspections of matériel, however, such inspections, like in the division, must be arranged through command channels.

Although charged with the responsibility for Ordnance general supply for the corps troops, here again, as in the division, no personnel and no facilities under the direct control of the corps Ordnance officer are available to meet this responsibility. It has been met, usually, by the utilization of personnel from the heavy-maintenance company. Sometimes this may be wholly satisfactory, but at other times it may be at the expense of proper maintenance and repair work. It is to be hoped that in the contemplated reorganization of the corps, as set forth previously in the study of "Field Service Problems," there will be provided a supply section organized and equipped to render this service.

IT has become quite a general custom to designate the bivouac of the corps Ordnance heavy-maintenance company as the refilling point for Ordnance general supplies for the entire corps—divisions as well as corps troops. At best, this is only a make-

*This discussion presents the personal views of the author and does not represent official policy on the subject.

shift and, in general, could afford a point of supply for only the spare parts and limited items of individual equipment carried by the heavy-maintenance company as part of its authorized equipment. It is contrary to the present concept of the supply functions of a corps and is in violation of paragraph 71 *d* (2) (a) (ii), Volume II, Manual for Commanders of Large Units, quoted above.

As a matter of convenience and accommodation, and as a sample of the coöperation that should exist between all elements of Ordnance service, corps units should assist divisional and subordinate units wherever and whenever possible, but to expect or to attempt to establish a regular flow of Ordnance general supplies through the corps heavy-maintenance Ordnance company to components of the corps, or even to the Ordnance companies thereof, is unsound, not contemplated by regulations, and not authorized. In emergencies, the heavy-maintenance company may be called upon to make issues of such items as may be available from its stocks to divisional maintenance companies and other units suffering from similar emergencies, but as a routine procedure this practice is to be discouraged.

"Ordnance service is responsible for the behavior of ammunition and its correct functioning until it has completed its mission." With that quotation from the Ordnance Field Manual there is no disagreement or conflict anywhere. But there is not such unanimous agreement with reference to the authority and responsibility of Ordnance service for the supply of ammunition. The Ordnance Field Manual says, "The responsibility of Ordnance service for the distribution of artillery ammunition ends when the ammunition leaves the refilling point; for small-arms and aircraft ammunition when it leaves the distributing points."

The Manual for Commanders of Large Units says, "Provision for and distribution of ammunition to include the operation and maintenance of army ammunition depots, the maintenance of the unit reserve of ammunition in corps and division Quartermaster trains, and the distribution of small-arms ammunition are responsibilities of the Ordnance service" (Par. 76 *b* (5)). The Staff Officers' Field Manual, in Part I, says that the Ordnance officer is responsible "for the supply of ammunition as far forward as the refilling point"; and in Part II, it says that "the supply of small-arms ammunition is a function of the Ordnance officer."

From these several quotations it reasonably may be deduced that the corps Ordnance officer, when the tactical situation is such as to require the establishment of corps refilling points, will be responsible for the proper stocking of all kinds of ammunition in such refilling points and the proper operation of those establishments; and that in all cases he will be responsible for the supply of small-arms ammunition for corps troops down to and including the operation of such small-arms ammunition distributing points for corps troops as may be established. Depending upon the terrain, the road net, the tactical situation, the distribution of corps troops, and the status of transportation, the corps troops' small-arms distributing points and the corps' refilling points may or may not be at the same places.

TO operate these ammunition supply installations, the corps Ordnance officer has under his control one Ordnance ammunition company which, at the present time, consists of 6 officers and 164 enlisted men of all grades. Parenthetically, it might be observed that on November 1, 1918, the A.E.F. GHQ approved T/O 242, authorizing an ammunition supply company of 6 officers and 216 men for *each combat division*. However, despite the experience which produced this action in the A.E.F., the only ammunition supply personnel now authorized in a corps, outside of the artillery brigade ammunition trains, is this one Ordnance ammunition company.

An Ordnance ammunition company is not an ammunition transportation unit in any sense of the word. The only transportation authorized is, as noted previously, merely sufficient to transport the company baggage and organizational impedimenta. Its personnel is sufficient only to provide the technically trained administrative and supervisory functions required in the operation of an ammunition supply point of limited size. To prepare the ground for the establishment of an ammunition supply point and to operate that supply point, labor must be supplied from Engineer and Quartermaster labor units. The requirements for this labor must be indicated by the corps Ordnance officer in his recommendations for the Ordnance plan for the corps. The organization of an Ordnance ammunition company and its general method of operation has been briefly covered previously. (Vol. XVII, No. 100, January-February 1937, p. 236, and No. 101, March-April 1937, p. 298.)

The ammunition for the original stocking of these corps ammunition supply points may come from the corps Quartermaster trains which (according to the 1936 edition of Reference Data, Command and General Staff School) carry, as part of their prescribed load, 908 tons of ammunition. This load includes, approximately 5760 rounds of 75-mm. ammunition, 4320 rounds of 155-mm. howitzer ammunition, 960 rounds of 155-mm. gun ammunition, 2772 rounds of 3-inch antiaircraft artillery ammunition, and 144 tons of small-arms ammunition for both infantry and antiaircraft artillery use. The tactical situation, however, may be such as to indicate the desirability of keeping this ammunition mobile; *i.e.*, on wheels, still loaded in the Quartermaster train. In such cases, the ammunition for the initial stocking of corps ammunition supply points must be drawn from army ammunition depots or other indicated points and transported to the corps ammunition installations by transportation furnished either by the corps or higher echelons.

The disposition of this corps Quartermaster trainload of ammunition must be indicated in the corps Ordnance plan. In the event this load is to be kept mobile, the corps Ordnance plan must contain instructions, based on approved recommendations and in accordance with the army Ordnance plan, as to where the ammunition for the corps ammunition supply points will be obtained, the transportation required, and other pertinent information.

The supply of ammunition being based fundamentally on expenditures and stocks on hand, accurate and up-to-date records must be kept in the corps Ordnance office of ammunition receipts and issues, stocks on hand, balance due on credits to the corps and the status of allocations to subordinate units. The duties, functions, and responsibilities of the corps Ordnance officer with reference to reports of expenditure, allocations, routes thereof, and information concerning them are covered in the discussion of "Ammunition Supply" (Vol. XVI, No. 96, May-June 1936, p. 371).

THE maintenance facilities provided organically as part of corps special troops have as their primary mission the maintenance of Ordnance matériel pertaining to corps troops. They also must be used to back up the divisional maintenance facilities. But this does not mean that there is a regular flow of Ordnance matériel back and forth between the corps repair facilities and the divisional facilities. In Ordnance field maintenance activities, the work that should be undertaken and which can be done is controlled by two factors—the limitations of equipment and the availability of time. In general, if these two factors prevent the divisional maintenance company from effecting the repair, the unserviceable item should be evacuated directly from the division through army Ordnance installations and the regulating station to the line of communications.

If the use of the larger and more elaborate equipment of the corps heavy-maintenance company only is required, then the item may be taken back to the corps and repaired. The corps heavy-maintenance company is intended to back up the divisional

maintenance companies only in this respect, and the bulk of the unserviceable articles going to the rear from the divisions should be evacuated directly as indicated above. However, no rigid rule can be formulated by which the relationships of these maintenance units can be controlled. The time-worn expression "it all depends upon the situation" is truly applicable here.

Maintenance is closely linked with supply, and the better the maintenance, the lighter and simpler will be the supply problems and burdens. Once an item becomes unserviceable, the primary mission of maintenance is the removal of this item from the channels of evacuation and its return to service.

The organization and operation of the heavy-maintenance company can be covered in a few words. There is general agreement with the opinion that this company as now organized and equipped is far from satisfactory. Although a portable unit, it is not exactly a mobile unit. Its equipment is perhaps too heavy and too elaborate for the jobs which it may handle within the limits of time available. Its personnel is perhaps too large for the tasks which properly fall within its scope. The reorganization of the corps maintenance unit is now under consideration by the Ordnance Department and it can be stated confidently that a better, a more mobile, and a more efficient unit will be developed. Whatever may be the final approved form of this maintenance unit, it will perform its maintenance functions, be controlled in a military sense, marched, bivouacked, and operated in practically the same manner as previously described for the Infantry division Ordnance maintenance company.

ONE more thought on this corps maintenance set-up: The Ordnance medium-maintenance company organically a part of the corps artillery brigade was originally assigned to that brigade when the artillery prime movers were Ordnance tractors and when it was also the approved mission of that company to maintain the trucks of the brigade. With the substitution of Quartermaster Corps wheeled prime movers for so many of the Ordnance tractors, and with the development of Quartermaster Corps mobile motor-repair units, it is within the realms of possibility that the need for this Ordnance maintenance unit no longer exists in the artillery brigade and that one Ordnance maintenance may be developed which will adequately, effectively, and efficiently accomplish all corps Ordnance maintenance functions.

While it is the function of the Quartermaster Corps to operate the salvage service, it is also provided that "in order to insure the proper sorting of salvaged property, it is essential that the several services be represented by competent personnel at points where salvage is collected."

It has been mentioned above for the first time in this series of articles that under certain circumstances the unit Ordnance officer may have functions involving the demolition of Ordnance items. As here used, it means the destruction of Ordnance stores in the unhappy event of a withdrawal, either voluntarily or under pressure from the enemy. Ammunition is usually the item which has to be destroyed.

It is provided that one of the functions of the chief of a supply service on the staff of a commander is "supervision of accountability for supplies." In the combat zone, no formal accounting for supplies is required. Nevertheless receipts usually are taken for all supplies issued and it is the duty of Ordnance service in the combat zone to bring to the attention of the commander concerned, all instances of Ordnance supplies being wasted or misused, or accumulated in unauthorized surpluses.

Although I indicated in the opening remarks of this discussion that the duties of a corps Ordnance officer were somewhat of a cross between those of an army Ordnance officer and those of a division Ordnance officer, I think that what has followed has indicated that the corps Ordnance officer has a worthy task and a big job. And so he has. (*Concluded.*)

Ordnance in Review

NOMENCLATURE OF ANCIENT ARTILLERY, PART II

BY LIEUT. COL. CALVIN GODDARD, *Ord. Res.*

This compilation of names and brief descriptions of obsolete pieces of ordnance is continued from the September-October 1937 issue (Vol. XVIII, No. 104, p. 105).

CANNON Serpentine: In the time of James I, a gun of 7-inch bore weighing 5500 lbs. and firing a 53½-lb. ball with 25 lbs. of powder. (According to another source, the ball weighed 42 lbs.)

Carronade: Short iron guns with reduced windage, named for the Carron works in Scotland where they were produced. Lighter than the conventional gun of the period, they were especially useful at close quarters, and were known as "Smashers." They varied in size from a 12-pounder weighing 600 lbs. to a 68-pounder of about 3600 lbs. The powder charge varied from one-sixteenth to one-eighth that of the ball (Current *circa* 1800).

Cavalot: Obsolete cannon carrying a 1-lb. ball.

Cochorn (Mortar): A small bronze mortar mounted on wooden blocks with handles, weighing 164 lbs. and throwing a 24-lb. shell 1200 yards (Named for its originator, Baron von Cochorn). Also: A small howitzer or motar, generally of 4 3/5-inch caliber.

Courcier (Fr.): A gun formerly placed in the forecastle of a galley for firing over the ship's beak. Its ball weighed 33-34 lbs.

Crackys (of War): General term for cannon in England during the fourteenth century. First used about 1327.

Culverin-Whole (Culverin-Proper): In the fifteenth century, this was an 18-pounder of 5000 lbs. (Others describe it as firing an 18-35 lb. ball, and having a bore of 5.2 inches.) In the time of James I, it had a 5½-inch bore, weighed 4500 lbs., and fired a 17½-lb. ball with 12 lbs. of powder. Another definition is "A long cannon of the fourteenth-sixteenth centuries with serpent-shaped handles." The famous "Queen Elizabeth's Pocket Pistol" at Dover, is said to be an example of a large culverin.

Culverin-Bastard: This is variously described as of 4- to 4½-inch bore, weighing 2500-3000 lbs., firing a ball of 5-7¼ lbs. (according to one authority, 11-20 lbs.), 9 feet in length, and drawn by 11 horses. Charge: 5¾ lbs. of powder.

Culverin-Demi (Demy): Commonly a 9-pounder of 4-inch bore, weighing 3000-3400 lbs., with a 3-lb. powder charge and ranging to 1740 paces (Described also by some as carrying a ball of 8-18 lbs.).

Culverin-False: An early French 6-pounder.

Culverin-Great: A 15-pounder, 10 feet long, weighing 4000 lbs. and drawn by 17 horses.

Culverin-Hand: A small, well-made cannon of the fifteenth century. The match was fastened to the weapon itself, and held by the serpentine.

Culverin-Middle: A French cannon of the time of Henry II, firing a 2-lb. shot.

Culverin-Quarter: (Same as a "Saker," *q.v.*) A gun of 3.65-inch bore, firing a 6-lb. shot to a distance of 1630 paces.

Culverin-Small: A French 2-pounder of 1550, weighing 1200 lbs. Also a German gun of the same period, firing a 20-lb. (?) shot.

Curricle Guns: Small pieces mounted on a 2-wheeled carriage drawn by two horses. Their tumbrils (caissons) carried 6 rounds of ball cartridge. Current in 1800.

Curtal (Curtald): Ancient piece of ordnance peculiar for its shortness, whence comes its name.

Demi-Cannon: A 4000-lb. gun of 6½-inch bore firing a 33½-lb. shot with 18 lbs. of powder. Also variously described as firing

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Demi-Carthoun: A 6000-lb., 24-pounder current in the fifteenth century.

Dragon: A 6-pounder of 1200 lbs., current in the fifteenth century. Later, a 40-pounder.

Dragon-Volant: An ancient French piece of 32 lbs.; obsolete by 1800.

Elephant: A German 18-lb. mortar current in 1565.

Epignare (Epingare, Espingard, Spingard): A small gun firing a ball not over 1 lb. in weight. Current *circa* 1800. Also a very small gun firing a ball of less than 1 lb. and in use as early as the fourteenth century.

Falcon (Faucon, Faulcon): A 6-pounder of the fifteenth century weighing 2500 lbs. (By one author, described as a 3-pounder.) Also (period of James I) a gun of 2½-inch bore weighing 660 lbs. and firing a 2-lb. shot with 3½ lbs. of powder. During the time of Francis I it appears to have carried a ball of 1 lb., 10 oz., and to have weighed 700 lbs. Another definition is "An ancient 4-pounder, 7 feet long."

Falconet (Faulconet, Fauconneau): Variously described as: A 1-pounder of 500 lbs. weight; A 2-pounder of 1000 lbs. weight; A 3-pounder of 3000 lbs. weight; A 1½-pounder—weight not indicated. Under James I it had a 2-inch bore, weighed 500 lbs., and fired a 1½-lb. ball with 3 lbs. of powder. In the mid-fifteenth century it was 6 feet 4 inches long, weighed 410 lbs., and fired a 14-oz. shot. Another source holds that it was a 1-pounder of 2-inch bore with a range of 900 paces.

Galloper: A gun of small caliber formerly attached to British infantry regiments; obsolete by 1800.

Gingal (Jingal): A portable piece of East Indian ordnance mounted on a swivel.

Gomer Mortar: A mortar with a *conical* chamber, so designed that a shell loaded from the muzzle was bound to fit the bore at some point (Named for inventor).

Goodwin Cochorn: A small Coehorn mortar fixed on a stake driven into the ground at a suitable angle and fired by a lanyard and trigger.

Hand Cannon: A small bombard affixed to a straight piece of wood and fired from the shoulder with a match.

Hobits: A small mortar of 6-8-inch caliber mounted on a carriage; preceded the howitzer; range: two to three miles (?).

Jingal (Gingall): A small, portable, gun fired from the ground or a wall, resting on a long slender butt and a bipod (East Indian).

Lantaka: A small, swivel-mounted gun used by Malay tribes.

Leather Cannon: A type introduced by Gustavus Adolphus which, because of its lightness, possessed great mobility. (Leather entered largely into the fabrication of its built-up barrel.)

Malabar Guns: Heavy pieces of ordnance made in the Malabar country with barrels of parallel iron bars, ringed by hoops; long and unwieldy (East Indian).

Minion-Large: A cannon of 3¼-inch bore, weighing 1000 lbs., and firing a 3¾-lb. ball with 3¼ lbs. of powder. Its length was 8 feet, and its range, when fired with the bore horizontal, 125 paces (Current *circa* 1810).

Minion-Ordinary: A gun of 3-inch bore weighing 1000 lbs. Length, 7 feet. Ball weighed 3 1/3 lbs. and powder load was 2½ lbs. Level range, 120 paces.

Minion: A gun with 3½-inch bore firing a 4-lb. shot with 4 lbs. of powder and weighing 1000 lbs. Range. 1400 paces. (Period of James I.)

Minion-Drake: A small seventeenth-century cannon.

Moyenne (Moienne, Moyan, Moyen): A 4-pounder, 10 feet long, and weighing 1300 lbs. (In the latter part of the sixteenth century, a 2¾-pounder). In the fifteenth century its ball weighed but 10-12 oz.

Mortar (Hand): A portable mortar fixed at the end of a 4½-foot shaft which was driven into the ground. Manually elevated for direction with one hand, and fired with the other. Much used before the invention of the Coehorn.

Mortar (Land): Heavy mortars for siege work. Elevation fixed at 45 degrees, and movable on skids only.

Napoleon: Field gun of medium caliber and weight without a chamber. The bore diameter was that of a 12-pounder. The gun was 13¾ calibers long, and weighed 1200 lbs. Introduced in 1856, it replaced lighter and heavier types formerly used.

Obus: A small mortar mounted on a gun carriage rather than the conventional mortar carriage.

Obus Cannon: Nonshattering shrapnel which projected their balls as does a cannon.

Obusier: A kind of light howitzer.

Partridge: A very light bombard anciently used in sieges and in defensive works. Mentioned by Froissart.

Passandeau: An ancient 8-pounder weighing 3500 lbs.; 15 feet long.

Passe-Mur (Fr.): An early cannon weighing 4200 lbs. and firing a 16-lb. shot.

Passe-Volant (Fr.): A light gun used in France in the fifteenth century. (A "Quaker" gun; *i.e.*, a dummy cannon, according to one authority.)

Perrier (Pierrier, Pedro, Perer): Primitive gun of large bore for firing stone shot.

Paterero (Pederero, Pattarero, Pedero, Paterero): A small swivel gun. Commonly placed on the quarter-deck of ships to repel boarding parties.

Pelican (Fr.): An ancient 6-pounder weighing 2400 lbs.; 9 feet in length.

Petard: A short cannon, loaded to the muzzle, fixed to a surface (door, wall, etc.) to be blown apart.

Pot Gun: A mortar for saluting purposes. A short, wide cannon, formed like a pot.

Quarter Cannon: A seventeenth-century 12-pounder.

Rabinet: In the fifteenth century, a small cannon, intermediate between a falconet and a base, with a bore of about 1½ inches; length, 5 feet, 6 inches; weight, 300 lbs.; firing a 1-lb. ball of 1⅜-inch diameter, with 6 oz. of powder. Later (period James I) its bore was 1 inch and the shot it fired weight ½ lb. The charge was three-quarter lb. of powder, and the range, 750 paces.

Rebuffo: A bastard cannon or "three-quarter carthoun." Also: A 36-pounder of 15 calibers. (According to Ufano, a 45-pounder.)

Ronfleur: A 12-pounder 22 calibers long, named by Frederick the Great.

Royal: A small mortar carrying a 5½-inch shell.

Saker (Sacar, Sacre): This was produced in various types such as the small, medium, and large saker. During the fifteenth century, these were rated as follows: saker-small: A 6-pounder of 1300 lbs.; saker-medium: A 7-pounder of 1500 lbs.; saker-large: An 8-pounder of 1800 lbs. The *sacar* (James I) had a 3½-inch bore, weighed 1400 lbs., and fired a 5½-lb. shell with 5½ lbs. of powder. The *saker* is described as a 4- to 5-pounder, 13 feet long, weighing 2500-2800 lbs. According to Tartaglia, the *sacre* of 1546 was a 12-pounder, 9 feet long, weighing 2150 lbs.; similar to the aspic but longer. It was also (later) known as a "quarter-culverin" (*q.v.*) in which form it had a bore of 3.65 inches, and fired a 6-lb. shot.

Sarre: An early piece of artillery smaller than the bombarde.

Scorpion (Fr.): An ancient gun whose dolphins resembled the scorpion.

Serpentine: A fifteenth-century, 4-pounder weighing 800 lbs. Later a gun of 1½-inch bore, firing a ¾-lb. shot, with a charge of 1½ lbs. of powder. Also: An ancient matchlock wall piece firing an 8-oz. lead ball with 4 oz. of powder. The length was 6-7 feet, and weight, 100-200 lbs.

Serpentix (Fr.): An early 24-pounder, 13 feet long, weighing 4360 pounds, whose dolphins resembled the figures of serpents. (Probably another name for culverin-proper, *q.v.*)

Suédoise: A species of light cannon superseding the leather gun. Very light and strong and suitable for mountain work.

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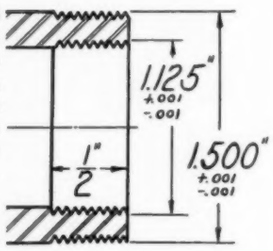

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Syren: A fifteenth-century cannon firing a 60-lb. ball.

Terrass: An old name for a mortar.

Tinker: A small mortar formerly mounted on the end of a staff. A hand mortar.

Tonnere (Fr.): Guns and artillery in general.

Tormentum: Any weapon using gunpowder as a propellant.

Verat (Fr.): A 12-pounder of 17 calibers, weighing 2300 lbs. Powder charge of 8 lbs.

Wagenburg: The first "field artillery," consisting of guns mounted on carts. Introduced by John Ziska, *circa* 1420.

Zumbooruk: A swivel gun.

Table I gives specifications covering British ordnance in use during the mid-seventeenth century. It is reproduced here by permission of Messrs. W. T. Spencer, booksellers, 27 New Oxford St., W. C. London, from a volume on their shelves entitled "The Art of Gunnery," by Thomas Smith of Barwick (London, 1643). Some of the figures were but indifferently legible; *e.g.*, those for the diameter of the ball fired from the fawconet.

BRITISH ORDNANCE IN 1643

	Diameter of Bore	*Diameter of Ball*	*Weight of Ball*	*Weight of Charge*	*Length of Gun*	*Weight of Gun (Without Carriage)*
	(Inches)	*(Inches)*	*(Lbs.)*	*(Lbs.)*	*(Feet & Inches)*	*(Lbs.)*
Cannon	8	7 3/4	64	32	12—0	8000
Cannon Serpentine	7 1/2	7 1/4	52	26	11—6	7000
French Cannon	7 1/4	7	46 3/4	23 1/4	12—0	6500
Demy Cannon—Eldest	6 3/4	6 1/2	36 5/8	20	11—3	6000
Demy Cannon—Ordinary	6 1/2	6 1/4	32	18	10—6	5600
Demy Cannon	6	5 3/4	24 1/2	16	11—0	5000
Culvering	5 1/2	5 1/4	19	15	13—3	4600
Ordinary Culvering	5 1/4	5	16 1/4	12 1/2	12—0	4300
Demy Culvering	4 1/2	4 1/4	11 1/4	9	11—0	3000
Demy Culvering (Something less)	4 1/4	4	9	7 2/3	10—0	2300
Saker—Ordinary	3 3/4	3 1/2	6	5	9—6	1900
Sakeret or Minion	3 1/4	3	4 1/4	3 1/2	8—0	1100
Fawcon	2 1/4	2(?)	2 2/3	2 1/4	7—0	750
Fawconet	2 1/4	2	1 1/8	1 1/2	6—0	400

TABLE I

It will be noted that as bores decreased, the weight ratio of powder charge to ball steadily advanced. Thus, while in the heavier types this ratio stood at 1 : 2, in the smaller it reached, and even surpassed, a ratio of 1 : 1. A reverse trend prevails in

COMPARABLE ORDNANCE OF WORLD WAR PERIOD

	Diameter of Bore and Projectile (Approx.)	*Weight of Projectile*	*Weight of Charge*	*Length of Gun*	*Weight of Gun (Without Carriage)*
	(Inches)	*(Pounds)*	*(Pounds)*	*(Feet & Inches)*	*(Pounds)*
8-in. Gun, Vickers, 1917	8	100	23	18—3	10,248
155-mm. G. P. F., 1918	6	95	25 1/4	19—5	8,795
4.7-in. Gun, 1906	4.7	45	6	11—3	2,688
75-mm. Gun, 1916	3	10 1/2	1 1/2	7—7	749

TABLE II

modern ordnance (Table II). Thus the weight ratio of charge to projectile for the larger calibers is now but 1 : 4, decreasing to 1 : 7 for the smaller pieces. (*Concluded.*)

Editor's Note: Colonel Goddard's compilation of the nomenclature of ancient artillery should be of real value to all students of armament. Admittedly incomplete, it is a guide which indicates the need for an inclusive glossary of ordnance terms. We hope in future issues to present such a contribution to the literature of ordnance both for current and future reference.

Chronicle

A WAR DEPARTMENT, Administration-approved proposal to increase the officer strength of the Army to 14,459 now is awaiting the opening of the regular session of Congress. If the measure is adopted it is probable that it will be carried out on a 5-year basis. Although it does not provide for an increase in general officers, the proposal would increase the promotion list strength to 12,599 and the nonpromotion list to 1793. Together with 67 general officers, this would make a total commissioned personnel of 14,459. Of the proposed increment, 2092, nearly all, would go to the Air Corps.

More than 500 new airplanes were procured for the Army Air Corps during the past year. Bomber procurement centered about the long-range, 4-engine type, such as the Boeing B-17 powered by four 1000-horsepower motors, and the medium-range bomber, such as the Douglas B-18 powered by two 1000-horsepower engines. The A-17 was the principal item of attack-plane procurement while in the reconnaissance class the 0-47 was procured in the largest quantity. The single-engine Curtiss B-36, capable of high speed and great maneuverability, was the fighter type bought in greatest numbers. This is a low-wing all-metal monoplane with retractable landing gear. The 2-place BT-9 low-wing, single-engine plane and the BT-13, a biplane, were the training airplanes procured in greatest quantity.

ACCORDING to Secretary of the Navy Claude A. Swanson, the Navy Department in the 1939 naval appropriations estimates, will ask Congress for funds to build new battleships. Two new battleships will cost approximately $60,000,000 each. The Navy also is tentatively considering building two experimental speedboats with torpedo tubes fore and aft. The Navy's building program also includes the following: Two light cruisers of 7500 tons mounting 6-inch guns, to cost about sixteen million dollars each; six submarines to cost about six million dollars each; four to six destroyers to cost about five million dollars each; a 9000-ton submarine tender, a 600-ton mine sweeper, an 1150-ton fleet tug and an 8000-ton oiler—these four totaling upward of $27,000,000 in cost. In addition, an increase of 3500 enlisted men and 1000 Marines also will be requested in the budget.

Piloted by Edmund T. Allen, consulting engineer and test pilot of the Boeing Aircraft Company, with Maj. John D. Corkille as copilot, the new XB-15 bomber successfully completed its first test flight at Seattle, Wash. Similar in appearance to the Army's 4-engine "Flying Fortress," the new bomber has a weight of more than thirty tons and a wingspread of 150 feet. It is powered by four Pratt & Whitney 1000-horsepower Wasp Sr. engines, each of which may be reached through the wings during flight. Two auxiliary gasoline engines within the airplane power the generators for the 110-volt alternating current electrical system which uses approximately seven miles of wiring throughout the craft. The bomber has a double-truck retractable landing gear with four large pneumatic tires and air operated landing brakes. Complete living and sleeping quarters are provided for the crew. Besides elaborate radio equipment, the new ship also has an automatic pilot, de-icer, fire-protection apparatus and landing flaps. Armament is mounted in a nose turret, a top turret, and in four streamlined "blisters"—one on each side and two on the bottom of the fuselage.

GEN. DOUGLAS MACARTHUR, former Chief of Staff of the Army, retired from active duty on December 31, 1937. Since 1935, General MacArthur had been military adviser to Manuel Quezon, President of the Philippine Commonwealth, organizing

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the Philippine defense forces. His military service began more than thirty-eight years ago with his appointment to the U. S. Military Academy. Rising rapidly through the various grades, he became a brigadier general during the World War—commanding for a time the famous 42nd (Rainbow) Division. During his five years as Chief of Staff, much progress was made in reorganizing and reëquipping the Army. Among his more outstanding accomplishments in this line are the establishment of the Four Army Plan and the formation of the GHQ Air Force.

Ninety-five basic combat airplanes and spare parts totaling $1,490,972.96 recently have been ordered by the War Department from North American Aviation, Inc. of Inglewood, Calif. These are low-wing 2-place cabin monoplanes with tubular steel, fabric-covered fuselages. The wings and stabilizers are metal. Their equipment includes landing flaps, retractable landing gear, and automatic controllable-pitch propellers. Pratt & Whitney, 550-horsepower single-row radial engines, furnished by the Government, will power the new craft.

The War Department also has awarded a supplemental contract to the Douglas Aircraft Company of Santa Barbara, Calif., for twenty-nine additional Model A-17-A attack airplanes at a cost of $654,155.90. These will be constructed by the Northrop Corporation, a Douglas subsidiary. They are low-wing monoplanes carrying a pilot and gunner. Powered by Pratt & Whitney 2-row engines developing more than 750 horsepower, the craft have an 8-hour cruising speed of over 220 miles per hour. Armament consists of four fixed caliber .30 guns and one flexible caliber .30 gun. Twenty small bombs can be carried internally or four larger bombs externally.

AN important project in the Federal Works Program is the rebuilding of the arsenal at Ogden, Utah. Work was begun in January 1936 and included reconditioning of the depot shops, garage, administrative buildings, engine house, machine shops, water system, and grounds. Much of the unit had not been used since 1929 when high winds destroyed part of the buildings. It is planned to complete the rehabilitation of the depot and construct at least thirty-five igloo-type magazines—the safest known type for the storage of ammunition. They are constructed of steel and concrete and are set in the ground two feet.

A new type of aërial gunnery target manufactured by the Air Corps Matériel Division at Wright Field, Ohio, is in the form of a panel sixty feet long and six feet wide, and is so designed that it can be towed through the air in either a horizontal or a vertical position. As many as 7000 feet of cable have been used in towing the target, although it is thought that 4800 feet will protect the towing plane sufficiently. The new target will permit practice in mass firing by pursuit airplanes on a flying target—a type of gunnery already being practiced by pursuit ships against slower moving targets on the ground.

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Book Reviews

GREEK AND ROMAN NAVAL WARFARE. By William L. Rodgers, Vice Admiral, U. S. Navy (Retired). Annapolis, Md: United States Naval Institute. $6.00.

IN the subtitle of his book, Admiral Rodgers outlines the scope of his undertaking as "a study of strategy, tactics, and ship design from Salamis (480 B.C.) to Actium (31 B.C.)." It is difficult to conceive how the work could have been better done—which is not surprising, for Admiral Rodgers brings to his task the invaluable qualities of thorough familiarity with naval operations and naval construction and noteworthy ability as an historian.

In this work there is no assumption of an innate knowledge of ship construction and naval tactics that is apparently frequently taken for granted in naval histories. In words comprehensible to the layman and the landlubber the author pictures the antique naval vessels not only in lucid text, but in drawings and photographs, so that the length and beam of these ships, their draft and tonnage, their speed and maneuverability, their offensive and defensive capacities are perfectly clear.

Admiral Rodgers makes full use of archæological evidence, such as paintings on vases and walls, mosaics and sculptures, but the answers based on this evidence and on the descriptions in early histories, have given rise to much controversy over the details of these ancient men-of-war. The author's contribution to the solution of these problems is one in which it is possible to put great reliance. He writes: "As the practice of shipbuilding in the Mediterranean embodied a continuous tradition, we may with advantage draw inferences from the construction of medieval and later rowing ships of which we have full accounts, and apply these to earlier ships."

With this accompanying description of ships and their tactics, the study of naval history emerges from among those activities requiring painful concentration to an intelligible and delightful pastime. It may come as a surprise to find that the opening campaign described is that of Marathon—on land—but Admiral Rodgers points out that during the period of naval warfare considered in this volume weapons were directed against men rather than against the ships themselves. Naval battles were struggles of infantry on shipboard. Nevertheless in all these centuries the influence of sea power was the same as it is today, and the understanding of this period of naval warfare is an essential aid to the comprehension of the present. Admiral Rodgers' book provides this understanding with rare clarity. D. A.

DIGNITY, A SPRINGER SPANIEL. By Maj. S. P. Meek, Ord. Dept., U. S. Army. Philadelphia: The Penn Publishing Co. $2.00.

MAJOR MEEK, an officer of the Ordnance Department, long ago established a reputation for himself as an author of animal stories for young and old. "Franz, A Dog of the Police," and "Frog, The Horse That Knew No Master" are well remembered.

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As to the author's ability on technical subjects, we have only to refer to earlier issues of ARMY ORDNANCE. O. E. D.

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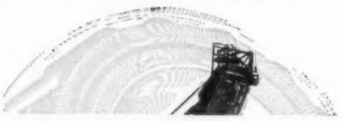

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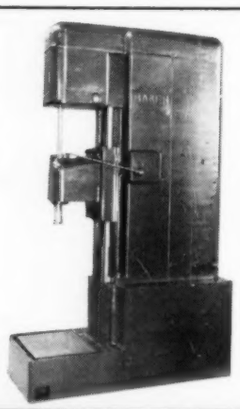

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